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SVIC NOTES

The Changing Nature of Scientific and Technical Meetings

My last "SVIC Notes" dealt with some of the changes in the content of meetings on shock and vibration that have taken place during the past 15-20 years, and I also pointed out the nature of meetings on shock and vibration, as well as meetings on other scientific and technical disciplines, has changed during that same time period.

I believe more scientific and technical meetings are held today than in the past, and some have questioned whether so many meetings are really necessary. The concerns often expressed about the increase in the number of meetings are the papers tend to be repetitious, and in some cases, they tend to be trivial. Without getting too involved in the issue of whether so many meetings are necessary, multiple presentations of a paper sometimes may be justified if the paper is presented to an entirely different audience. This helps to promote an interchange of ideas among a wider group of people.

One reason why the number of scientific and technical meetings may have increased is more meetings are being held to discuss specialized topics. For example, in the shock and vibration technical area, specialized meetings have been held to discuss topics such as vibrations in rotating machinery, modal testing and analysis, and damping. These specialized meetings are often useful because they permit a topic to be discussed in more detail than would be possible in meetings of a more general interest. Another benefit of the specialized meetings is they often bring together many of the specialists in a field, and this also helps to bring about a wider interchange of ideas.

Another change in the nature of scientific and technical meetings is related to their attendance. With a few exceptions, the attendance at most scientific and technical meetings has declined during the past 15-20 years, and there are many reasons for this decline. Some of these reasons are the lack of time to attend meetings, an increase in the number of meetings on a given topic, and economic conditions.

Scientific and technical meetings in the United States have attracted foreign participants for many years, but during the past few years the level of foreign participation has substantially increased. The significance of this increase lies in the greater number of countries that are represented in the scientific and technical meetings that are held in this country.

The technological aspects of conducting meetings have also changed, and these changes have appeared in the visual aids and the projection equipment used in the meetings. Twenty years ago the 3 1/4 x 4 in. slide format was the most common. Today, this slide format is rarely, if ever, used; it has been replaced by overhead transparencies and 35 mm slides, and both slide formats are equally common. Overhead transparencies have become popular because they can be prepared more rapidly and more economically than the other slide formats. In some cases a copying machine is all that is needed. But, with the advent of one hour photo processing services, 35 mm slides may often be prepared almost as conveniently and as rapidly as overhead transparencies. When speakers need movies for visual aids, most still use the 16 mm movie format; but many people have recognized the convenience of using video tape, and they are using it in place of movies. While the video tape format is convenient, it does have a potential disadvantage, compared to 16 mm movies, in that its projected image is smaller; however, the smaller projected image may only be a serious disadvantage in large and crowded meeting rooms. If I were to make any predictions about the nature of audiovisual equipment in future scientific and technical meetings, one prediction would be that the video tape format will replace 16 mm movies when movies are required for visual aids.

RHV

EDITORS RATTLE SPACE

Recently, I expressed my thoughts on the problems associated with the publishing industry. Quality vs quantity has been one of my major concerns as I deal with the published literature from day to day. Large quantities of lesser quality technical material are published each month. Some of this material is created to place words on paper to react to publisher pressure to fill magazine space. The small amount of quality published technical material is lost in this volume of lesser quality material. This makes it very difficult to identify the literature that is new because it requires a time consuming search and review process. One of the functions of the DIGEST as a secondary journal is to partially perform this task for the reader.

It is the goal of the Literature Review section of the DIGEST to screen and distill the literature in narrow technical areas. To perform a literature review, a survey of all existing literature in the area must be conducted. This literature is distilled to obtain the valuable new published technology. This means that the surveyed material is screened for applicable new technology. The new technology is organized for presentation in a useable manner. This process of literature distillation requires a large amount of effort by an experienced person. Since most researchers are busy with their daily work, it is difficult to obtain good review articles. However, in the interest of efficient dissemination of the literature it is important that we publish timely articles. For this reason, we are offering a free three year subscription to the DIGEST for each review article. If you wish to participate in this program please contact me.

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HIGH TEMPERATURE DAMPING OF DYNAMIC SYSTEMS

D.I.G. Jones*

Abstract. This article describes progress in three major areas of high temperature vibration control technology since 1982: high temperature materials, design and applications, and frictional damping.

This article updates the author's earlier reviews of high temperature damping [1-3]. Progress in three areas of high temperature vibration control technology is described.

HIGH TEMPERATURE MATERIALS

The reduced temperature nomogram described in an earlier review [2] has become a widely used technique for summarizing and disseminating complex modulus data for viscoelastic materials as a function of frequency and temperature. The nomogram is an effective tool for designing damping treatments and for displaying, storing, and evaluating data [2-4].

Recent developments include the composition of such high-temperature polymeric damping materials as polyimides, polysulfones, and silicones [5]. These materials are currently available only in small quantities for research and evaluation purposes, but they could form the basis for effective solutions of vibration control problems at temperatures in the range 300°F (149°C) to 800°F (427°C). They are likely to remain expensive for a long time, and the range of effective damping is relatively narrow.

DESIGN AND APPLICATIONS

A damping design guide to be published in the near future [7] will emphasize design for applications in aerospace structures. However, the information will also be of value in other industries. After the design guide is available, it is anticipated that experience gained from using it will result in improvements and recognition of areas requiring further development. Applications of finite element techniques for design of damped structures have been described [8, 9]. An investigation of the control of flutter in unshrouded fan blades in jet engines may be particularly useful for future development of highly efficient jet engines [10, 11]. A new textbook on vibration damping has been published [12].

FRICTIONAL DAMPING

Analytical and experimental investigations have been carried out for frictionally damped systems [13-28]. Some of these investigations have utilized finite element approaches [14]; others have used two-degree-of-freedom discrete modes [13, 22, 26]. A modified two-degree-of-freedom model has been developed that allows the accurate modeling simultaneously of the first two modes, natural frequencies, and modal masses [27]. This is in contrast to the usual two-mass two-spring model which has insufficient parameters to simultaneously model all aspects of behavior in the first two modes of vibration.

CONCLUSIONS

Damping technology is being applied to such industries as automotive, aerospace, and equipment at an expanding rate. The result is that the technology base is being utilized to a greater degree than before. In addition, the tools available are becoming better known; they include information about types and properties of viscoelastic materials and techniques for analyzing dynamic response of damped systems. Refinements of the state of the art are taking place, but major breakthroughs are not expected.

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LITERATURE REVIEW: survey and analysis of the Shock and Vibration literature

The monthly Literature Review, a subjective critique and summary of the literature, consists of two to four reviews each month, 3,000 to 4,000 words in length. The purpose of this section is to present a "digest" of literature over a period of three years. Planned by the Technical Editor, this section provides the **DIGEST** reader with up-to-date insights into current technology in more than 150 topic areas. Review articles include technical information from articles, reports, and unpublished proceedings. Each article also contains a minor tutorial of the technical area under discussion, a survey and evaluation of the new literature, and recommendations. Review articles are written by experts in the shock and vibration field.

CURRENT STATE OF KNOWLEDGE ON STRUCTURAL CONTROL

A.M. Reinhorn* and G.D. Manolis*

Abstract. Structures occasionally experience extreme loads, especially during earthquakes or in a high wind environment. Furthermore, it is now becoming possible to deploy large and flexible structures in space. In both cases the response of the structure must be controlled within certain bounds dictated by serviceability. The problem is energy dissipation from or energy input to the structure through external mechanisms. Traditionally, energy has been dissipated through damping. Passive control devices have been used that basically supplement the damping characteristics of a structure. Semi-active and active control devices have recently been introduced. They promise a more efficient use of the resources available for control and improved accuracy in controlling the response of a structure.

Structural control in engineering is a relatively new subject that has developed in the last 15 years [1]. Investigations on ways to account for the effects of lateral loads on such flexible structures as extremely tall buildings or long bridges and to suppress vibrations in aircraft pointed to structural control as one of the most imaginative techniques available. Much progress has been made since the idea of using active tendons to control the sway of buildings was proposed independently by Freyssinet in 1960 and Zetlin in 1965 [2].

Simply stated, control of a structure implies using devices to assure that its overall performance during application of loads remains within certain prescribed limits. Traditionally, energy dissipating mechanisms activated by motions of the structure have been used. This approach is known as passive control [1, 3-6]. More recently, the use of mechanisms powered from external sources so as to counteract the effects of applied loads has been suggested. This concept is known as active control [7]. The vast amount of work that has been done on the various aspects of structural control since the 1970s, with special emphasis on recent advances in civil and mechanical engineering, is summarized below.

PASSIVE CONTROL

Energy dissipating devices, which can be replaced if they are extensively damaged, form the backbone of the passive control approach. Examples of such devices include:

- Soft metal U-shaped stirrups or short bars incorporated between moving surfaces or used as diagonal bracing systems [4, 8]. The plastic bending and/or torsion of such devices is an extremely efficient energy dissipation mechanism.

- Stepping structures, in which the column-to-foundation connection is designed in such a way as to allow uplift (separation). It is thus not necessary to design the foundation to withstand high tensile stresses. Stepping frames tested at the University of California at Berkeley survived severe shaking [4]. A railway bridge and a chimney employing this type of foundation construction have been built in New Zealand [4, 8].

- Structure-foundation base isolation using steel reinforced rubber bearings [4, 9]. The rubber bearings are designed to undergo large deformations, thus dissipating large amounts of energy. The superstructure undergoes elastic vibrations [10]. Newly devel-

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oped lead core rubber bearings [11] are even more efficient because the lead core, which behaves as a hysteretic material, also absorbs energy. Several forms of rubber bearings are reported in use in the United States, New Zealand, and Switzerland [12, 13].

- Dynamic absorbers, which have been commonly used in the vibration control of machinery, are relatively new in structural engineering. Dynamic absorbers are mass-spring systems added to a structure and are also known as tuned mass dampers (TMD). They are efficient in dissipating both harmonic [14, 15] and random [16] vibrations and have been placed in tall buildings such as the Hancock Tower in Boston and the Citicorp Center in New York [1, 17].

- The expendable top story approach, in which the top story is designed to yield substantially in order to reduce the response of the lower stories, is also new [18]. Although potentially very efficient, this approach requires excessive ductilities from the top story that are difficult to achieve at present. A variant of this approach is the well known first soft story approach [19]; it is losing popularity because the large deformations sustained by the first story result in loss of stability of the entire structure.

Although passive control approaches lead to a predictable reduction in the response of a structure, the devices used require maintenance replacement after activation. The greatest limitation of passive control, however, is that it is applicable to only one mode of vibration [3, 17, 20, 21]. It is also possible to enhance the effectiveness of most passive control devices by adding active control capabilities [3, 17, 20].

SEMI-ACTIVE CONTROL

For improved performance, a TMD in a building was augmented by a semi-active damper [22]. This concept originated in the field of vehicle vibration isolation. The damper consists of a piston-cylinder combination supplemented by a control valve assembly. The assembly consists of a control-valve actuator with lever arm and valve. During the semi-active mode of operation, electrical signals from a control computer initiate control-valve actuator motion. If the piston is moving relative to the cylinder, different levels of damping are produced. Control is accomplished by measuring the force in the damper and comparing it to a reference force that is a function of the variables of the system. The energy required for control is minimal because only the motions of the control valve must be generated. The semi-active TMD was shown to be comparable to a totally active system and superior to a passive system.

ACTIVE CONTROL

Active control is a well known method in both electrical and aeronautical engineering but is relatively new in civil and mechanical engineering. The mathematics behind active control are well developed [23, 24], at least insofar as linear systems and linear controllers are concerned. Since the early 1970s, when Yao [7] suggested using active control in conventional structures, a number of methods have been proposed:

- Aircraft are routinely designed with movable parts that are controlled by electromagnetic or servo-controlled hydraulic devices [25, 26] in order to suppress flutter and increase drag. The forces involved in such control, however, are very small when compared with the forces required to control civil engineering structures.

- Tuned mass dampers or dynamic absorbers can be coupled with external active power supplies operated by rational control algorithms implemented on digital or analog computers; such devices produce a larger reduction in response with smaller forces [17, 27-29]. These control systems can be used in structures undergoing either earthquake motions or wind vibrations.

- The use in building structures of appendages that resemble variable geometry aircraft wings has led to

substantial reductions in the displacements of tall buildings under wind gusts [30-32]. The appendages are movable and their position is computed based on current deformation measurements.

- Tendons or cables, added to buildings and bridges, can be tensioned using hydraulic rams. The internal forces that are generated are used to adjust deformations of the structure. Sensors are used to monitor its response to external loads. If the response exceeds certain limits, the controller determines the required adjustments and sends electric signals to the hydraulic actuators; these in turn pretension the tendons to computed values. This tendon-induced control has been proved feasible to implement [28, 29, 33-37].

- More recently, the use of pulses has been suggested for structural control [38-48]. Pulses are thrusts applied over a short period of time in the form of either air and gas jets or tendon prestressing using pulse generators located at various positions in the structure. The pulses are applied to the structure during discrete time intervals; their intensity is computed by a control algorithm based on response measurements. The method is not very different from the one that employs tension-induced control except that larger time intervals can be used.

In general, active control requires continuous monitoring of system response (displacements, velocities, accelerations) and of input disturbances (loads). In addition, a control algorithm is necessary to determine the control forces as well as to define the state of the system from available information. Active control algorithms can be classified according to the way data are used for control, the kind of control rule employed, and the size of the system controlled.

Based on the way data are acquired, three types of control can be identified:

- Closed loop (feedback) control, in which only system response is used to estimate control forces [17, 21, 26, 28, 30-38, 49-60].

- Open loop control, in which only disturbances are monitored and used in determining control forces [47, 61, 62].

- Open-closed loop control, in which both actual structural response and disturbances are used in estimating control forces [61-63].

Several investigators have shown that the open-closed loop is the most efficient way for structural control [62]. However, a large amount of information must be processed compared to the other two.

The type of control rule is the basis of the following classification:

- In optimal control the control force is obtained by extremizing a cost functional. The cost functional is usually the total energy of the system including work done by the control forces. Minimizing the cost functional leads to a Ricatti type equation the solution of which yields a control gain matrix. Such solutions require large computational effort. For elastic systems with stationary disturbances, the Ricatti equation can be solved offline; the result is a substantial reduction of on-line computations. Optical control based algorithms are very efficient for use with TMDs, tendons, appendages, and pulses [20, 26, 31-33, 43, 44, 49-51, 53, 56, 58-61, 64-67]. A list of 270 references on optimal feedback algorithms alone can be found in Robinson [68].

- Suboptimal control implies that cost functionals do not include all of the characteristics of the system. Thus, simplified models result at the expense of global optimality [39, 69].

- Non-optimal control implies that control forces are calculated based on conditions other than the extremization of a functional. The result is that the magnitude of control forces is no longer the minimum required.

Among the conditions used in non-optimal control are modal control, total control, pulse control, and non-optimal TMD method.

- Modal control (pole assignment) uses modal characteristics of a structure (natural frequencies and mode shapes) as well as damping to adjust overall response [21, 27, 28, 36, 37, 39, 44, 47, 48, 55, 57, 64, 70-74]. The modal characteristics must be accurately computed; the locations of both sensors and control forces are important.

- Total control uses a transfer matrix formulation in the frequency domain [28, 29, 60, 67, 75-78]. TMDs or tendons are used as the control devices; harmonic or random disturbances can be considered. The advantage of total control is that it requires no prior knowledge of the modal characteristics of a system and no deterministic time input.

- The use of pulse control (step-by-step control) is dependent upon system response requirements [45, 46, 79] or the ease of force generation and application [38, 39, 41-44, 47, 48].

- With the non-optimal TMD method, one mode is actively controlled without any information on the behavior of the remaining modes [77]. The result is an efficient but not optimal system performance.

Finally, depending on the size of the system, modal control algorithms can be further classified as

- Full size control algorithms that take into account all modal shapes of a structure. A sufficient number of sensors and controllers must be used. This method is the original modal control case mentioned previously and is suitable for discrete systems of small size. It is well known [80-82] that these algorithms are not suitable for distributed parameter systems (DPS) or for large building and space structures.

- Reduced order models in modal control use only a few modes for the computation of control forces [49, 54, 55, 57, 62, 67, 72, 76, 78, 81, 83, 84]. Engineering considerations dictate the choice of modes, which are known as critical modes. The sensors and actuators used to monitor and control the structure are less than the total number of modes of the structure. Inherent in such reduced observation and control is the problem of amplification of the effect of uncontrolled modes; the problem is known as spillover [23, 85]. Considerable efforts have been expended to overcome spillover effects, and various methods have been suggested. Monitoring and controlling of spillover is sometimes incorporated within the main control algorithm [55, 57]; in other cases transfer matrices [62, 78] or integral equations in conjunction with suitable Green's functions [86-90] are applied to the entire system. If spillover is adequately controlled, the reduced methods retain their advantages of simplicity and of moderate computational effect.

EXPERIMENTAL WORK

The structural control methods reviewed above have found only limited applications in standard engineering practice. Passive control techniques have usually been implemented because simple engineering mechanisms that do not require electronic instrumentation and on-line computations are used. Among the reported implementations are torsional absorbers, stepping structures, and base isolation systems for earthquake and wind hazard mitigation in New Zealand, the United States, and Switzerland [4, 8, 9, 12, 13]. As far as the performance of such devices is concerned, the TMDs in the Hancock Tower and in the Citicorp Center [1, 17] have been found satisfactory in reducing wind-induced vibrations to human comfort levels.

The implementation of active control to structures is still in the experimental investigation stage. Experiments include:

- Tests of several slender beams controlled by *electromagnetic* actuators have used analog filters for modal decomposition [83]. The response of these beams was satisfactorily reduced using a modal control algorithm.

- Tests of a light beam with the control supplied by an on-line microprocessor connected to a mass damper feedback loop [91].

- Several tests have been performed on simple beams using tendons connected to servo-hydraulic actuators as the controlling devices [34]. A non-optimal feedback algorithm was employed.

- One of the first successful tests on structural models using appendages was done recently [32]. The appendage was placed on top of a scaled tall building model and was activated by a solenoid coupled to an analog control circuit operating on an optimal feedback algorithm. The experimental set-up was tested in a wind tunnel; the appendage was shown to be efficient in reducing displacements at the top of the model.

- Optimal velocity feedback was used in wind tunnel experiments to control the flutter of aircraft wings [26]. A similar algorithm in conjunction with electromagnetic actuators and optical displacement sensors (which do not touch the structure and as a consequence do not interfere with its response) was used to control a simple beam [56].

- The use of pulses as a control device was recently tested using a servo-controlled air jet generator on a six-story building model. Results showed a substantial reduction of overall response [38, 39].

- Tendon control has also recently been tested [92] using an on-line microcomputer to generate optimal feedback signals computed from monitored values of system variables. Despite some difficulties caused by time delays in the data acquisition system, tendons proved to be efficient in controlling the response of a three-story 1:4 scale model subjected to base motions.

OVERVIEW

The following table summarizes the range of applications of the two basic types of structural control available today, namely passive and active systems. This table is adapted from Yao [1] by permission.

Applicability of Structural Control*

		Passive	Active		
Purpose	Structural Response	Always Available	Frequent Use (Small Control Force)	Occasional Use (Moderate Control Force)	Almost Never Used (Large Control Force)
Comfort	Warning Limit	X	X		
	Elastic	X	X		
Safety	Tolerable Damage	X		X	
	Repairable Damage	X		X	
	Near Collapse	X			X

* Heavy line is the border between existing devices and algorithms and future extensions.

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BOOK REVIEWS

STRUCTURAL DYNAMICS THEORY AND COMPUTATION

M. Paz
Van Nostrand Reinhold Co.,
New York, NY
Second Edition, 1985, 561 pages

This is the second edition of a comprehensive book in the area of structural dynamics written by an expert who is also a successful educator. New topics include Rayleigh's method, dynamic condensation method, and an introductory chapter on random vibration. The five main parts of the book take the reader from fundamentals to advanced topics.

The eight chapters of Part I deal with a description of dynamics of structures modeled as a single degree-of-freedom system. The basic concepts of damped and undamped free vibration of single-degree-of-freedom systems are treated in the first two chapters. Simplifications for modeling such complicated systems as frame structures and semi-definite systems by equivalent single-degree-of-freedom systems are given. Chapters 3 and 4 deal with the response of single-degree-of-freedom systems to harmonic excitations and arbitrary excitations. The student can use the computer program DUHAMEL to calculate the dynamic response to general dynamic loading based on the Duhamel integral. Chapter 5 introduces Fourier analysis for the determination of response in the frequency domain. This chapter contains two computer programs, FOURIER and FREQRESP, for calculating the response of damped oscillators to periodic excitation. The fast Fourier transform (FFT) is outlined and implemented by the subroutine FREQRESP. Complicated structures consisting of multiple interconnected rigid bodies or having distributed mass and elasticity are treated in Chapter 6. Concepts of analytic dynamics such as the principle of virtual work and Rayleigh's method are used. A brief description of nonlinear structural response is given in Chapter 7. The author highlights elastoplastic behavior and an algorithm (STEPS) for analyzing elastoplastic systems. Chapter 8 introduces response spectra with reference to earthquake engineering design. A tripartite response spectral plot is described in terms of acceleration, relative displacement, and relative pseudovelocity. The use of response spectra for elastic and inelastic design of structures subjected to dynamic loading is well described.

Part II consists of five chapters that deal with the dynamic behavior of structures modeled as shear buildings. The static properties of multistory shear buildings are described in terms of stiffness and flexibility matrices in Chapter 9. The undamped free vibration of a shear building is analyzed in Chapter 10. This chapter addresses the eigenvalue problem and the orthogonality property of normal modes. It also includes a computer subroutine called JACOBI to calculate the eigenvalues and eigenvectors of structural systems with a symmetric stiffness matrix. Chapter 11 introduces the modal superposition method for determining the response of a shear building subjected to either force excitation or base motion. However, the absorber effect known in mechanical vibration is not discussed even though it is one of the main features of forced vibration of two-degree-of-freedom systems. The influence of linear viscous damping on the motion of shear buildings is discussed in Chapter 12. The problem of decoupling the equations of motion with linear damping is outlined under certain well known conditions for the damping matrix. The computer subroutine DAMP is given; it is used to determine the damping matrix associated with normal coordinates. Chapter 13 introduces some methods for reducing the size of system matrices involved in the eigenvalue problem. They include the static condensation and dynamic condensation methods. The application of these methods is enhanced by the computer program CONDE.

The dynamic analysis of framed structures modeled as discrete multi-degree-of-freedom systems is given in Part III. This part begins with a description of the dynamic behavior of structures represented by beams. The static properties for a beam segment are used in constructing the assemblage (global) beam stiffness matrix. The inertia properties are established via the lumped mass method or the consistent mass method. Other properties such as damping properties, external loads, and geometric stiffness are briefly outlined. These basic ingredients comprise the finite element method for beams; a computer program BEAM is given to determine the natural frequencies and mode shapes of beams. Chapter 15 deals with the dynamic analysis of plane frames. Outlines of the process for constructing element stiffness and mass matrices for axial effects are given with reference to local or element coordinates. These matrices are then transformed from local coordinates to global coordinate axes. The dynamic analysis of plane frames is performed by the computer program FRAME. Chapters 16 through 18 consider the dynamic analysis of grids, three-dimensional frames, and trusses. The treatment outlined in Chapter 15 is used in the three chapters. Chapter 19 is concerned with the numerical analysis of nonlinear multi-degree-of-freedom systems. The Wilson-O method is introduced; it provides numerical stability of the solution process regardless of the magnitude selected for the integration time step. A computer program STEPM is provided to perform step-by-step integration of the nonlinear equations of motion. This chapter also includes a section on the elastoplastic behavior of framed structures.

Part IV is devoted to the dynamic behavior of structures modeled with distributed properties. The treatment of free vibration of a uniform beam represented by a continuous system is given for various types of boundary conditions. The forced vibration of beams is modeled in terms of normal beam modes by a set of uncoupled set of nonhomogeneous ordinary differential equations. Determination of dynamic stresses requires determination of the bending moment and shear force from the deflection function of the beam. Chapter 21 introduces simplifications to the analysis of continuous systems that can be discretized into a finite number of modes. The dynamic influence coefficients that relate forces and displacements at the nodal coordinates of a beam element are derived for flexural, axial, and torsional effects. This chapter also includes the effect of simultaneous action of longitudinal and axial forces acting on a beam.

Part V consists of Chapter 22, which is additional material to this edition. The basic concepts of random vibration analysis are described; they include the statistical properties of random stationary processes, such as the mean, mean square, autocorrelation function, and spectral density function. Special distributions such as the Gaussian and Rayleigh probability distribution functions are defined. Random processes are classified into narrow-band, wide-band, and white noise processes. This background is then used to determine the response of single-degree-of-freedom systems to random excitation.

Three appendices are given at the end of the book. The first contains compilations of computer programs cited in the book; the second is a glossary of terminology; and the third provides answers to problems in the first eight chapters.

The book can be regarded as an encyclopedia, but the author has cited a few references as footnotes. An outstanding feature is that it is self-contained. The reader can use his personal computer to gain insight into the applications of numerical solutions and the finite element method to structural dynamics without buying any software. In addition, the style of the book reflects the ability of the author to simplify the subject of structural dynamics. For these reasons the book is recommended for both undergraduate and graduate courses of mechanical vibrations or structural dynamics for civil and mechanical engineering students.

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A FIRST COURSE IN ANALYTICAL DYNAMICS

K. Rossberg
John Wiley & Sons, New York, NY
1983, 291 pages, $33.00
ISBN 0471-86174-X

It is a common notion among dynamicists that vectorial dynamics is based on Newton's laws and that analytic dynamics is based on energy concepts that led to Hamilton's principle and Lagrange's equation. This book covers a number of topics from both newtonian and analytic dynamics. The material reflects the personal views of the author. The book is well arranged and self-contained.

The first two chapters include an introduction and mathematical preliminaries. The introduction contains useful information about reference frames, coordinate systems, and standard units of mechanics. The second chapter introduces the concept of vectors in terms of Cartesian, cylindrical, and spherical coordinates. The calculus of vectors includes derivatives in the three coordinate systems, integration of vectors with respect to one variable, the del (or *nabla*) operator, and line integrals. Other topics such as complex numbers, matrix theory, coordinate transformations, tensors, polar and axial vectors, and the eigenvalue problem are introduced. The presentation of these mathematical concepts as a separate chapter may not suit instructors who prefer to incorporate them in the relevant topics of a dynamics course.

The kinematics of a particle is described in terms of three space coordinate systems. An excellent treatment of the circular motion of a particle is given. The motion of a particle about an axis of rotation is expressed mathematically by orthogonal matrices with unit determinant. The total time rate of change of a vector subject to changes in magnitude and direction is derived. The relative motion of one particle with respect to another is briefly described.

Chapter 4 deals with newtonian mechanics. The three laws of Newton are described; however, no reference is given to the free body diagram used in establishing the equations of motion. Instead, the author introduces two related approaches, namely impulse-momentum and work-energy theorems. The properties of conservative forces and their relationship with potential energy are well described.

A brief mathematical description of linear oscillations is presented in Chapter 5. Within the framework of linear theory of small oscillations the free and forced oscillations of single-degree-of-freedom systems are treated for physicists rather than engineers. The construction of Lissajous' figures is well explained in terms of the phase angle. The variation of natural frequency with the amplitude of oscillation is described using the energy concept rather than the nonlinear analytical approach. The motion of a particle under the influence of a constant magnetic field is shown to follow a left-handed circular helix at an angular frequency known as the cyclotron frequency.

Chapter 6 introduces the motion of particles under central forces. The well known differential equation for the orbit of a particle under central force is derived. This equation is then solved formally by constructing the energy integrals. The three Kepler's Laws of planetary motion are introduced. The orbits in the inverse square force field are derived from the effective potential energy. The concept of scattering cross section is introduced. It is basically a measure for the probability, in units of area, that a certain reaction takes place.

The dynamics of many particle systems are established in Chapter 7. Center of mass, force and momentum, and torque and angular momentum are vectorially analyzed. A special case of two particle systems is included. The collision of two particles under no external forces is treated in connection with particles of dilute gases.

Formalisms of the Lagrange and Hamilton equations, which constitute the core of analytic dynamics, are treated in Chapter 8. The author introduces the concepts of generalized coordinates and two well known classes of constraints, namely holonomic and nonholonomic. The basic ingredients of Lagrange's equation such as virtual displacement, virtual work, generalized forces,

and kinetic energy are outlined. The generalized moments and ignorable coordinates are introduced without reference to the Routhian. Hamilton's equations and a number of related topics such as velocity dependent potential energy are discussed very briefly.

The dynamics of rigid bodies in space motion and gyroscopic motion are treated in Chapter 9. The author introduces the equations of motion and defines mass moment of inertia, principal moments of inertia, angular momentum, and kinetic energy. The rotations of a rigid body about a fixed axis or a fixed point are analyzed. The stability of rigid body rotation under no external forces or torques is treated via Euler's equation. The motions of a symmetrical top under no torque or under the influence of a torque (the heavy top) are analyzed. Chapter 10 deals with the free vibration of coupled linear systems. The general formulation of the equations of motion for a multi-degree-of-freedom system is established for conservative systems using a Lagrangian formulation. The main characteristics of vibrating systems such as natural frequencies and mode shapes are discussed. To establish the normal coordinate transformation the author outlines a systematic mathematical approach to decouple the equations of motion. This approach is based on symmetric properties of inertia and stiffness matrices. Special attention is given to the eigenvalue of a weighted string (discrete system) and to continuous string (continuous system).

The book is clearly written and is recommended for junior students majoring in physics.

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STRUCTURAL MECHANICS SOFTWARE SERIES V

N. Perrone, W. Pilkey, B. Pilkey, Eds.
University Press of Virginia,
Charlottesville, VA
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The fifth book in this series is organized much like its predecessors. It is divided into three parts: Reviews and Summaries of Available Programs, in which several programs within five computational areas are reviewed; Reviews of Computational Mechanics Technology, in which chosen technologies are reviewed at length; and Resources for Engineers, which directs the reader to sources of computational software.

The computational areas reviewed in the first part are:

- heat transfer. an overview of capabilities of 38 programs ranging from large general purpose (e.g., ANSYS, MARC) to small special purpose.

- building analysis and design. a review of programs within three distinct groups: frame analysis only, member selection only, and integrated analysis and selection.

- error estimates and solving linear systems. discussion of properties of norms used to determine error estimates, evaluate programs on test matrices. The background of the LINPACK system is described in detail.

- U.S. general purpose finite element programs. comparison of documentation, element and material libraries, solution options, and eigenvalue extraction and time integration schemes for COSMIC/NASTRAN, MSC/NASTRAN, EASE2, STARDYNE, ANSYS, ABAQUS, ADINA, and MARC.

- finite elements in biomechanics. review of 36 general and special purpose programs in the mechanics of orthopedics, dentistry, impact injury,

cardiovascular system, soft tissues, and biological flow. An extensive list of references in each area is included.

The second part of the book contains three papers. The first is an extensive evaluation of the nonlinear shell analysis program STAGSC-1. The evaluation includes general capabilities, documentation, program architecture, and performance. The second paper reviews numerical integration methods for large systems of nonlinear, stiff, ordinary differential equations. Newmark, Runge-kutta, and predictor-corrector methods are included. The third paper reviews four techniques for reducing the number of degree of freedom in dynamics problems: exact reduction, Guyan reduction (static condensation), modified Guyan reduction, and dynamic reduction.

The final part of the book contains four papers on data bases and other sources of information on structural mechanics software. This fifth edition of the series does a good job of reviewing and surveying the selected areas and should be a good source of information for engineers involved in those areas. The editorial quality of this edition far exceeds that of the previous four editions.

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PRINCIPLES OF UNDERWATER SOUND

R.J. Urick
McGraw-Hill Book Co., New York, NY
Third Edition, 1983, 423 pages,
ISBN 0 07-066087-5

The first edition of this book was published in 1967 as "Principles of Underwater Sound for Engineers." The third edition provides the latest information available on underwater sound and data on sonar and its applications. The book emphasizes practical aspects and will thus be of considerable value to busy practitioners.

The 13 chapters cover 416 pages. The book begins with a comprehensive introduction to sonar equations and a historical perspective. The properties of transducer arrays, the computation of array gain, and transducer types and methods for calibrating them are discussed. Sound generation is addressed, as is sound propagation and its many effects, including transmission loss through a medium. Topics include basic theory, sound channels, and convergence zones. The formulas given help the reader grasp the characteristics and sources of reverberation and scattering. The theory of target strength as well as target strengths of mines, fishes, and submarines are discussed.

Vessels at sea emit a characteristic noise signature. These effects are described, as are processes of noise generation and the noise caused by sonar itself. A related area is detectability; detection theory is presented. The threshold concept is described, as are receiver operating characteristic curves and detection devices. Problem solving methods are given for designing sonar systems. Prediction methods for assessing how well a sonar system might work in a given scenario are also shown.

This book, like any good reference text, has well indexed references; example problems are given throughout. It would be helpful to the reader if a glossary of symbols were included.

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STANDARDS NEWS

Avril Brenig, Standards Manager

ASA Standards Secretariat, Acoustical Society of America, 335 East 45 Street, New York, New York 10017

William A. Yost

Parmly Hearing Institute, Loyola University of Chicago, 6525 North Sheridan Road, Chicago, Illinois 60626

American National Standards (ANSI Standards) in the areas of physical acoustics, bioacoustics, mechanical shock and vibration, and noise are published by the American Institute of Physics for the Acoustical Society of America (ASA). In addition to these standards, other Acoustical Society documents, a Catalog of Acoustical Standards—ASA Catalog 5-1984, and an Index to Noise Standards—ASA STDS Index 3-1985 (national and international) are available from the Standards Secretariat of the Acoustical Society. To obtain a current list of standards available from the Acoustical Society, write to Avril Brenig, at the above address. Telephone number: (212) 661-9404.

Calendar

The Fall meetings of the ASA standards committees are scheduled for Nashville, Tennessee, 4–8 November 1985.

1985 November 4, ASA Committee on Standards, 7:30 p.m., the Hyatt Regency, Nashville, Tennessee. Meeting of the Committee that directs the ASA Standards Program.

1985 November 6, Accredited Standards Committee S2 on Mechanical Shock and Vibration (also Technical Advisory Group for ISO/TC/108 and IEC/SC/50A), 2:00 p.m., the Hyatt Regency, Nashville, Tennessee. Review of international and S12 activities and planning for future meetings.

1985 November 7, Accredited Standards Committee S12 on Noise (also Technical Advisory Group for ISO/TC43/SC1), 9:30 a.m., the Hyatt Regency, Nashville, Tennessee. Review of international and S12 activities and planning for future meetings.

1985 November 7, Accredited Standards Committees S1 (Acoustics) and S3 (Bioacoustics) (also Technical Advisory Group for ISO/TC/43, IEC/TC/29, and ISO/TC108/SC4) at 1:30 p.m. at the Hyatt Regency, Nashville, Tennessee. The S1 meeting will be held first. Review of S1, S3, and international standards activities and planning for future meetings.

1985 October 14–16, Committee E-33, Environmental Acoustics, will meet in Philadelphia, Pennsylvania. Contact R. M. Guernsey, Cedar Knolls Acoustical Labs, Cedar Knolls, New Jersey 07927.

Standards News from the United States

The following news items have been received since the last issue of *Standards News*:

"Leap Second" to be added at the end of June

An extra second will be added to the official U. S. time scale at the end of June 1985. The leap second will be inserted into atomic clocks at the U. S. Naval Observatory in Washington, D.C., and at NBS in Boulder, CO, between 23:59 Greenwich time (7:59 p.m. EDT) on 30 June and the beginning of July. This will give the last minute, of the last hour, of the last day in June, 61 rather than 60 seconds. This is done worldwide by international scientific agreement in an effort to *keep clock time*, whose standard is the reasonant frequency of the cesium atom, *closely matched to solar time*, based on the Earth's rate of rotation. Atomic time is much more accurate than solar time because the long-term trend of the Earth's rotation is to slow down. The leap second keeps this discrepancy to *less than nine-tenths of a second*. This will be the 13th leap second inserted since 1972.

Booklet reviews ANSI's international role

A new ANSI booklet describes how the Institute carries out its responsibilities in international standardization.

Included is an overview of ANSI participation in the activities of the International Organization for Standardization and the International Electrotechnical Commission (through the USNC/IEC). Emphasized is the important role played by TAGs—technical advisory groups that develop the U.S. positions for international work.

ANSI's relations with government in international standardization are also reviewed. So is its role as an information center and source of international standards and drafts and the national standards of other countries.

Single copies of the booklet—*ANSI's Role in International Standardization*—are available without charge from the Communications Department.

Eicher nominated Secretary-General of International Organization for Standardization

The appointment of Dr. Lawrence D. Eicher to the post of secretary-general of the International Organization for Standardization (ISO) has been recommended to the ISO Council—the organization's governing body. The recommendation comes from a group comprised of ISO's president, vice-president, and members of the Executive/Finance Committee, which met in Geneva in May to consider applications for the position.

Dr. Eicher, an American, is extremely well-qualified for the position of chief staff executive of ISO, the world's major nongovernmental international standards organization. Since 1980 he has been assistant secretary-general, with responsibility for general executive management of ISO Central Office operations, overall coordination of technical committee work, and policy-level representation with other international and regional organizations. Dr. Eicher joined ISO after a distinguished career in science and in administration of standards-related programs at the U.S. National Bureau of Standards. From 1979–1980 he was director of NBS's Office of Engineering Standards. Before that, he was chief for several years of the Office of Standards Information, Analysis, and Development of NBS's National Engineering Laboratory. Dr. Eicher earned a Ph.D. in physical chemistry from Texas A&M University in 1971.

His appointment to the ISO post is expected to be made by Council at the organization's General Assembly in Tokyo in September. Dr. Eicher will succeed Mr. Olle Sturen, who will retire in 1986 after seventeeen years as secretary-general.

ISO develops, coordinates, and promulgates international standards that facilitate world trade, contribute to the safety and health of the public, and help protect the environment. Currently there are nearly 6000 ISO standards, produced by some 2300 technical committees and subgroups. It has a staff of 150 with headquarters in Geneva, Switzerland. The national standards organizations of 75 countries are ISO members. The American National Standards Institute is the U.S. member.

ANSI is a private, nonprofit organization that coordinates the development of voluntary national standards, approves American National

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Standards, and represents U.S. interests in the International Electrotechnical Commission (IEC) as well as in ISO.

What is NVLAP?

This Note is a general description of the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Bureau of Standards (NBS).

The aim of NVLAP is to provide, in cooperation with the private sector, a national voluntary system to examine upon request the professional and technical competence of private and public testing laboratories that serve regulatory and nonregulatory product and certification needs.

Anyone may request the creation of a LAP. The requestor must identify the product, standards, and test methods to be included in the goods, construction, materials, or associated services. The number of laboratories likely to request accreditation and the number of users who will seek accredited laboratories must be estimated. The requestor must also indicate the basic need for the LAP in terms of its potential public benefit, the lack of existing alternative systems, the existence of standards and test methods of importance to commerce or consumer well-being, and its feasibility and practicality.

The LAP proposal is published in the *Federal Register* to obtain public comment. If significant support is indicated, DOC will establish an industry advisory committee. After consultation with the committee DOC publishes in the *Federal Register* proposed accreditation criteria and estimates of fees it intends to charge for the service. If the public generally supports the proposal, the establishment of the LAP is formally announced and applications for accreditation are accepted from laboratories. Appeal procedures are set out to address and resolve any disagreements concerning DOC's accreditation decision.

It is important to note that NVLAP accreditation is voluntary and that NVLAP is supposed to be self-supporting. No laboratory is required by government regulation to seek accreditation. However, laboratory users may, if they want to, require that a laboratory be accredited by NVLAP.

Laboratories seeking accreditation must pay accreditation fees that are supposed to cover the cost of NVLAP. These accreditation costs will presumably be passed along to clients.

Further information about NVLAP can be obtained from: NVLAP, NBS, TECH B154, Washington, DC 20234. Telephone: (301) 921-3431.

Data needed on equal loudness contours

The S3 Accredited Standards Committee on Bioacoustics chaired by Dr. Laura Wilber, is seeking new published or unpublished data on equal loudness contours. The committee is especially interested in loudness measures of low auditory frequencies. Revisions of both national and international standards are underway and these data would be helpful in formulating revisions to the existing standards or in developing new standards. For information, contact Dr. Laura Wilber, Department of Communicative Disorders, Northwestern University, Evanston, IL 60201.

Standards News from Abroad

The following news items have been received since the last issue of *Standards News*:

ISO to meet in Japan

ISO's General Assembly, which meets every three years, will convene in Tokyo on 2–13 September 1985, at the invitation of the Japanese Industrial Standards Committee.

The schedule calls for plenary sessions of the General Assembly and meetings of the ISO Council and its Executive/Finance and Planning Committees. Two public sessions are also planned—one on benefits of standardization and the other on the role of standardization in fast-moving technologies.

A number of technical visits and trips are on the program, including a full-day trip to the International Exposition—Tsukuba EXPO 85. The data, 11 September, has been designated a special ISO day by the exposition's organizers. ISO is one of the exhibitors at the show, which runs from 17 March through mid-September.

Standards approved by ANSI and published by ASA

The following standards were approved and published by ASA:

ANSI S1.6-1984	Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurement (revision and redesignation of ANSI S1.6-1967)
ANSI S1.40-1984	Specifications for Acoustical Calibrators
ANSI S2.34-1984	Experimental Determination of Rotational Mobility Properties and the Complete Mobility Matrix, Guide to
ANSI S12.6-1984	Real-Ear Attenuation of Hearing Protectors, Method for the Measurement of the (revision and redesignation of ANSI S3.19-1974)
ANSI S2.40-1984	Mechanical Vibration of Rotating Machinery—Requirements for Instruments for Measuring Vibration Severity
ASA STDS INDEX 3-1985	Index to Noise Standards, 3rd Edition
ANSI/ASC S2.41-1985	Mechanical Vibration of Large Rotating Machines with Speed Range from 10 to 200 rev/s—Measurement and Evaluation of Vibration Severity *in situ*
ANSI S12.3-1985	Statistical Methods for Determining and Verifying Stated Noise Emission Values of Machinery and Equipment
ANSI S1.4A-1985	Amendment to ANSI S1.4-1983 Specification for Sound Level Meters

The above standards are available from the Standards Secretariat at the following address: AIP Publication Sales Department, Department STD, 335 East 45th Street, New York, NY 10017. (A 20% discount is available to individual and sustaining members of the Society.)

International documents on acoustics received in the United States

The documents listed below have been received by the Standards Secretariat of the Society and have been announced to S1, S2, S3, or S12. The document number is listed to the left of each document and the Accredited Standards Committee to which the document was announced is listed in parentheses below the document number. Further information on each document can be obtained from the Standards Secretariat.

The following documents have been received from ISO for vote:

ISO/DIS 2631/2 (S2/S3)	Evaluation of human exposure to whole-body vibration. Part 2: Evaluation of human exposure to vibration and shock in buildings (1 to 80 Hz)
ISO/DIS 226 (S3)	Acoustics—Normal equal-loudness contours for pure tones under free-field conditions
ISO/DIS 7566 (S3)	Acoustics—Standard reference zero for the calibration of pure-tone bone-conduction audiometers
ISO/DIS 8253 (S3)	Acoustics—Pure-tone audiometric test methods
ISO/DIS 7962 (S3)	Vibration and shock—Mechanical transmissibility of the human body
ISO/389 DAD 2 (S3)	Acoustics—Standard reference zero for the calibration of pure-tone air conduction audiometers
ISO/DP 8297 (S12)	Determination of sound power levels of multi-source industrial plants for the evaluation of the sound pressure levels in the environment—Engineering method
ISO/DIS 3989/1 (S12)	Acoustics—Measurement of airborne noise emitted by compressor units including prime movers. Part 1: Engineering method for determination of sound power levels

ISO/DIS 3989/2 (S12)	Acoustics—Measurement of airborne noise emitted by compressor units including prime movers. Part 2: Method for checking compliance with noise limits
ISO/DIS 3481/1.2 (S12)	Acoustics—Measurement of airborne noise emitted by pneumatric tools and machines. Part 1: Engineering method for determination of sound power levels
ISO/DIS 3481/2.2 (S12)	Acoustics—Measurement of airborne noise emitted by pneumatic tools and machines. Part 2: Method for checking with noise limits.

The following documents have been received from ISO for comment:

ISO/DP 8727—ISO/TC 108/SC4 N 150 (S2)	First draft proposal on standard and biodynamic coordinate systems
ISO/DP 8798 (S3)	Acoustics—Reference levels for narrow-band masking

The following documents have been received from IEC for comment:

IEC/SC 29C (Central Office) 52 (S3)	Audiometers, Part I: Pure tone audiometers (Revision of IEC 645)

Standards from other Standards Organizations

The following document(s) have been received from the Audio Engineering Society (AES) for comment:

EIA-517 (S1/S3)	Car audio standard
EIA-518 (S1/S3)	Tape recorder measurement

The following document(s) have been received from the Society of Automotive Engineers (SAE) for comment:

SAE J366 (S12)	Exterior sound level for heavy trucks and buses (completely revised November 1984)
SAE 1096 (S12)	Measurement of exterior sound levels for heavy trucks under stationary conditions (revised January 1985)

The following document(s) have been received from the Institute of Electrical and Electronic Engineers (IEEE) for comment:

IEEE P 656/E (S12)	Measurement of audible noise from overhead transmission lines

S1 Meets in Austin

Mr. T. F. W. Embleton, Chairman, has submitted the status report of S1, Acoustics. The committee met in Austin, Texas during the Spring meeting of the Acoustical Society held in April 1985.

S1-1 Standard Microphones and their Calibration—*V. Nedzelnitsky, Chair*

Mr. Nedzelnitsky reported at the meeting as follows:

Extensive comments of two working group members on the fifth revision of S1.12-1967 (Specifications for Laboratory Standard Microphones) draft were received after the last meeting (Minneapolis, 9 October 1984) and were resolved in Austin after thorough discussion. The second draft IEC document on this subject was also briefly discussed, and one aspect, nomenclature, was identified as of particular importance for efforts at consistency between ANSI and IEC documents. This will be attempted at the IEC meeting in Budapest on 17 April.

A sixth draft revision of ANSI S1.12-1967 will be prepared as soon as possible thereafter.

The need to revise or reaffirm ANSI S1.10-1966 (Calibration of Microphones) in 1986 was noted. It appeared that revision will be necessary, to begin at the next S1-1 meeting, in Nashville, in November 1985.

S1-2 Attenuation of Sound in the Atmosphere—*A. H. Marsh, Chair*

Mr. Marsh reported at the meeting that he expected to have a draft ready for ballot in one year.

The working group met on 10 April with the following results:

Lou Sutherland, the U. S. member of Working Group 24 of ISO, TC 43, SC1 reported his efforts to solicit inputs from U. S. investigators in preparation for the 1985 April meeting of WG24 in Budapest. WG24 is developing a draft International Standard on Sound Propagation Outdoors. The Standard is intended for application to a variety of practical situations such as prediction of the propagation of sound from an existing or a proposed noise source.

Jerry Karlsberg submitted data showing contours of atmospheric absorption coefficients as functions of temperature and humidity. Coefficients were calculated by the equations in ANSI S1.26-1978 and by the modified equations discussed at the 1984 October meeting of WG S1-2.

Lou Sutherland presented additional results from his re-analysis of available atmospheric-absorption data. The additional results provided further support for an additional mechanism in the de-excitation of nitrogen molecules by water molecules, namely by water in the dimer (two-molecule) form in addition to the more-common monomer (one-molecule) form. Hank Bass and Allan Zuckerwar discussed a possible analytical formulation of an equation for the nitrogen-relaxation frequency which could include the dimer effect.

Joe Piercy reported the results of calculations of the possible effect of a larger concentration of carbon dioxide in the atmosphere than the 310 parts per million in ANSI S1.26-1978. The larger concentration could occur as a result of the continued utilization of hydrocarbon fuels. It was concluded that the long-term trend for higher concentration of carbon dioxide should have a negligible effect on the constants in the equations in the standard until the 21st century, at the earliest.

S1-3 Integrating and Averaging Sound Level Meters—*A. H. Marsh, Chair*

Mr. Marsh reported on the December 1984 and April 1985 meetings of the working group as follows:

A copy of the galley-proof version of IEC *804 for Integrating-Averaging Sound Level Meters* had been received on 28 November 1984 from Leif Nielsen of the Danish Standards Association. The galley proof was said to be in the process of being reviewed by a "two-person Editorial Committee," (D. Robinson for the English-language part and Mr. Bruneau for the French-language part). At the request of Mr. Nielsen, Alan Marsh submitted comments to Mr. Nielsen on 7 January 1985 for consideration by the Editorial Committee. In a letter dated 28 January 1985, Leif Nielsen informed Alan Marsh that the comments were received too late to be incorporated and would be retained for a future edition of the IEC Standard.

A ninth draft (dated 26 November 1984) of the ANSI Standard for Integrating-Averaging Sound Level Meters was discussed at the meeting on 2 December 1984. Several technical and editorial changes were made. There was general agreement on the specifications for response to steady, sinusoidal electrical signals and associated tolerance limits. No consensus was reached on a suitable specification for an instrument's response to transient electrical signals, the principal options being the 4-kHz toneburst of IEC 804 and the proposed single-cycle sine wave.

A new Working Group 21 of IEC Subcommittee 29C of Technical Committee 29 was formed and will have its first meeting in Budapest on 18 April 1985. WG 21 has the charge to prepare an International Standard for a procedure to measure the response of conventional and integrating-averaging sound level meters to sound at random incidence, e.g., outdoors at random angles of incidence over a relatively long period of time or indoors in a reverberant space in a diffuse sound field.

The U. S. Technical Advisor to the U. S. National Committee for IEC TC 29 and TC 29/SC29C recommended that A. H. Marsh and R. W. Young be admitted to membership on WG 21. R. W. Young will attend the meeting of WG 21 on 18 April. A copy of a memo outlining various technical problems and approaches for random-incidence calibration was received on 16 March 1985 from Peter Hedegaard of B&K—Denmark and Secretary of WG 21.

At the meeting of *ANSI/ASC WG S1-3 on 8 April 1985*, A. D. Wallis of Cirrus Research discussed results of tests conducted with steady and transient electrical signals on various models of integrating-averaging sound level meters. Those tests had been performed in accordance with IEC 804 and the 8th draft (5 April 1984) of the proposed ANSI Standard. Detailed test data were not available but will be provided.

Copies of *the tenth draft (6 April 1985) of the proposed ANSI Standard* were distributed to WG S1-3 on 8 April 1985. The principal items of discussion about the proposed ANSI Standard were related (1) to the specification for response to transient electrical signals and (2) to omnidirectional response at random angles of incidence.

The specifications in the proposed ANSI Standard for omnidirectional response will be presented to IEC SC29C WG 21 as a suggested method for calibration in a random-incidence sound field.

After considerable discussion, no consensus was established for the preferred specification for the response of the instrument to transient electrical signals. The about-to-be-published IEC 804 document utilizes 4-kHz sinusoidal tonebursts or varying amplitude above a continuous, in-phase, low-level 4-kHz sinusoidal signal. Durations of the tonebursts are 1, 10, 100, and 1000 ms. The proposed ANSI Standard utilizes a more sophisticated test signal consisting solely of a single cycle of a sine wave. Further efforts will be made to obtain a consensus of WG S1-3 for the specification of response to transient electrical signals.

Members of WG S1-3 pointed out that several manufacturers of integrating-averaging sound level meters produce, or are about to produce, instruments that are designed to indicate a time-average sound pressure level from a continuously updated series of, for example, 125-ms average sound pressure levels. It was noted that the specifications for transient response in IEC 804 do not apply to instruments designed to display "short-L_{eq}" levels, as they have been called.

It was further noted that there was substantial support in Europe for immediately initiating an effort to revise the not-yet-published IEC 804. The revision would be intended to apply to all designs for integrating and integrating-averaging sound level meters. It was agreed that the most appropriate test signal for the revised version of IEC 804 would be a single cycle of a sinewave.

Therefore, *it was agreed that it would be appropriate to request the S1 Committee to request that the U. S. Technical Advisor to IEC SC29C offer a proposal (or support a proposal) to initiate work to revise IEC 804, particularly the response to transient electrical signals.* The revision would be intended to widen the scope of applications of the Standard for designs of integrating and integrating-averaging sound level meters beyond those instruments covered by IEC 804.

S1-4 Methods for the Measurement of Sound Pressure Levels in Air—*O. H. McDaniel, Jr., Chair*

(1) Time extension for S1.13, American National Standard Methods for the Measurement of Sound Pressure Levels, was approved on 14 July 1971 (reaffirmed in 1976). The current ANSI Executive Standards Council policy requires that S1.13 be revised and approved this year. It is the working group's opinion that this cannot be accomplished. The alternative is to reaffirm S1.13 for an interim period until the revision and approval can be completed. The following question has been raised: Can a standard be reaffirmed twice? The answer to this question was affirmative.

(2) Appendix A. Identification of Prominent Discrete Tones. S1.29, Method for the Measurement and Designation of Noise Emitted by Computer and Business Equipment refers to Appendix A for a method of prominent discrete tone identification.

S1.29 has been revised and a task team within that working group has developed a new method for identifying and evaluating prominent discrete tones, taking advantage of our vastly improved spectral measurement technology. It does not appear that this method will be included in the revision of S1.29; however, it has been suggested that the method be a part of S1.13 as a replacement of Appendix A. It is the opinion of the working group that it be included in the body of S1.13 rather than as an appendix. One of the authors of the improved method (Matt Noble) is now a member of WG S1-4.

(3) Appendix B. Measurement of Impulsive Noise. This important type of measurement can now be performed with varying degrees of sophistication with a variety of current off-the-shelf instruments and the working group is re-writing this procedure as a section in the body of S1-13.

(4) Measuring Nonsteady Noise. There is a need to specify one (or perhaps more) metrics as L_{eq}, L_{dn}, L_{10}, etc., for characterizing time-varying noise. Equation (1) in S1.13 is, in fact, the definition of L_{eq}. Suitable metrics are described elsewhere (such as in ANSI S3.23); however, it is felt that it would be suitable to include the most commonly used metrics. A survey of potential users of the revised S1.13 will be conducted to resolve this issue.

(5) Deletion of Outdoor Measurements from S1-13. Recommend that a working group be formed in S12 to cover this item. Chair will send a letter to Ken Eldred with a suggested scope and working group members.

S1-5 Band Filter Sets—*L. W. Sepmeyer, Chair*

A draft revision of S1.11-1966 (R 1976) was circulated to S1 for ballot on 16 April 1984. The ballot closed on 16 June 1984 with results as given in the last Minutes (S1/252).

Comments and a few negative votes on the draft of the proposed revision of S1.11 have led to a better approach to achieving a descriptor of digital filter response to sloping spectra. A new draft was prepared and sent to S1 ballot on 21 March 1985. The ballot will close on 2 May 1985.

At the meeting, Mr. Sepmeyer referred to the IEC document circulated for comment, with the suggestion that the reply should be a recommendation to include the latest technology in this document.

S1-7 Personal Dosimeters—*J. J. Earshen, Chair*

A draft of the proposed revision of ANSI S1.25-1978, Specification for Personal Noise Dosimeters, is expected for ballot shortly.

Mr. Earshen submitted a report (read by the Chair of S1 at the meeting) as follows:

Working Group S1-7 did not meet during the Austin meeting of ASA. The Chairman expects to have an initial draft of a Standard ready for S1 ballot before the Nashville meeting in November 1985. A principal technical issue is whether to require that a personal dosimeter incorporate the standard one-second exponential time constant when measuring sound by the "5-dB level-time exchange rule." The ballot will provide an opportunity for S1 members and experts to guide the Working Group on future drafts of the personal dosimeter standard.

S1-8 Acoustical and Electroacoustical Vocabulary—*S. L. Yaniv, Chair*

Ms. Yaniv has reported that she hopes to prepare a draft shortly. This draft will be circulated to the chairs of the respective terminology working groups in S2, S3, and S12 for their review prior to ballot.

Ms. Yaniv reported at the meeting as follows:

Draft document to replace S1.1-1960 Acoustical Terminology is being prepared. This document will be sufficiently different from the 1960 S1.1 to let the existing S1.1 die. No reaffirmation of existing S1.1 will be proposed. A draft document of the new proposed standard will be circulated prior to the next ASA meeting.

S1-9 Calibration of Underwater Electroacoustic Transducers—*A. L. Van Buren, Chair*

This working group is charged with revision of S1.20-1972 (R1977) Procedures for Calibration of Underwater Electroacoustic Transducers. Mr. Van Buren has reported as follows:

Progress on a draft of the revision of S1.20-1972 (R1977) Procedures for Calibration of Underwater Electroacoustic Transducers is going much slower than I ever imagined it would. Most of the delay results from the Chair's workload at USRD. Unfortunately, preparation of the draft usually manages to remain near the bottom of a long list of action items. It might be possible to obtain another two-year extension of S1.20-1972 (R1977).

S1-10 Scales and Ratios for Plotting—*R. W. Young, Chair*

The amended IEC Publication 263, 1982, 3rd Edition, Scales and Sizes for Plotting Frequency Characteristics and Polar Diagrams, is now available from ANSI.

At the meeting, Mr. Young reported that the galley proofs of the IEC document needed modification. Hopefully, the task would be completed in the near future, and a proposed American National Standard presented to S1 for ballot.

S1-11 Phase Response of Transducers—*V. Nedzelnitsky, Chair*

Mr. Nedzelnitsky reported at the last meeting that working group members were gathering information on methods for determining the phase responses of microphones in order to prepare a tutorial journal paper on the subject. It may also prove feasible to produce a paper or standard on relative phase response of microphone systems at low frequencies if a sufficient combination of existing data and data from experiments conducted in the near future can be obtained.

A short paper on needs and possibilities for standardization that was requested of the chairman for presentation at Inter-Noise 84 has been written and distributed. It is hoped that this paper will serve as a focus for subsequent discussion and comment in the future activities of the working group. At the meeting, Mr. Nedzelnitsky said that he would submit this paper directly to Ms. Brenig.

Mr. Nedzelnitsky said that two new members had been added to the working group: J. Tichy and J. He Kein (from China), the latter as observer. Mr. Nedzelnitsky expounded on the tasks assigned to this working group and how they were to be addressed, also responding to a question of Mr. Melnick's on details of the scope, which needed clarification.

S1-12 Specifications for and Calibration of Instruments to Measure Acoustic Intensity—*W. R. Thornton, Chair*

At the meeting, Mr. Krishnappa reported for Mr. Thornton as follows:

The current draft concentrates on microphone technique only and input is needed badly from the working group on sound power measurements (S12-21).

S1-13 Weighting Networks for Acoustical Measurements—*D. Flynn, Chair*

Mr. Flynn is preparing a draft standard (S1.42-198X) giving the amplitude response of A-, B-, and C-weighting networks. Considerable sentiment has been expressed for incorporating phase response and time-domain response in the proposed standard. (*It has been agreed that only weighting* networks A, B, and C should be included in this proposed standard.)

Mr. Flynn submitted a report stating that a document should be ready in June 1985.

Work Items Without Working Groups

(a) Proposed revision of S1.8-1969 (R 1976) Preferred Reference Quantities for Acoustical Levels: Mr. Embleton will be circulating a draft revision of S1.8 for ballot shortly. (It will use the traditional S1.8 reference values, noting that some are not exact SI units and that the proposed standard therefore differs from otherwise similar ISO standards.)

(b) Amendment: Specification for Sound Level Meters ANSI S1.4-1983: At previous meetings, an amendment to S1.4-1983, which was prepared by Mr. Wong, was proposed for circulation to S1 ballot. The amendment was not considered incompatible with S1.4 and the Standards Manager was instructed to investigate the appropriate procedure within ANSI to consider and vote on an amendment to a standard. A ballot was subsequently mailed to S1 on 10 August 1984 and closed on 21 September 1984. Based on the responses, a revised draft of the proposed S1.4 amendment was prepared and sent to S1 ballot on 30 November 1984. The ballot closed on 11 January 1985. A revised text was sent to 30-day review by S1 voting members on 15 February 1985. The 30-day review closed on 18 March 1985 with three vote changes: affirmative from *J. L. Sullivan*, representing the Exchange Carriers Telephone Group; two negative votes, from *C. D. Bohi*, representing the American Industrial Hygiene Association, and *E. H. Toothman*, representing the American Iron and Steel Institute. These comments are being addressed.

Report on activities of IEC SC29D and its Working Groups

(1) The following documents have been received for comment:

IEC/29D (Sec.)25	Draft: Ultrasonic Doppler Fetal Diagnostic Equipment, prepared by WG10.
IEC/29D (Sec.)26	Draft: Measurement and Characterization of Ultrasonic Fields using Hydrophones in Frequency Range 0.5 to 15 MHz, prepared by WG8.
IEC/29D (Sec.)27	Draft: Characteristics and Measurements of Ultrasonic Piezoceramic Transducers, prepared by WG3.

Comments will be offered by U. S. delegates to the April 1985 meeting of SC29D and its Working Groups.

(2) SC29D and its Working Groups will meet in Budapest, 15–19 April. The U. S. Delegation will consist of:

John M. Reid (WG10), Chief Delegate
Paul L. Carson (WG9)
James F. Kistler (WG6, nominee).

Charles F. Hottinger will also attend in his capacity as Secretary of WG6. These four experts will attend the meetings of WG3, WG7, and WG8 as appropriate, as Alternate to the permanent U. S. Representatives who cannot attend; specific assignments will be determined.

Discussions in all WGs are at the technical level; U. S. positions have been determined previously and communicated.

A new topic at Budapest will be the AIUM/NEMA Safety Standard for Diagnostic Ultrasound Equipment, as approved for introduction by the USNC Safety Coordinating Committee. SC29D may create a new WG to consider the suitability of this U. S. document for endorsement as an IEC standard or its revision, or may assign the task to an existing WG.

S2 meets in Austin

Mr. Paul H. Maedel, Jr., Chairman, has submitted the following report on the S2 Committee on Mechanical Vibration and Shock. The committee met in Austin, Texas, during the Spring meeting of the Acoustical Society in April 1985.

Chairmen of the working groups reported on their progress on both national and international standards as follows:

S3-39(S2) Human Exposure to Mechanical Vibration and Shock—*H. E. von Gierke, Chair*

Resolutions of the SC4 meeting held in Edinburgh in September 1984 are available from the Standards Secretariat.

At the meeting there was discussion as to whether ISO 6897-1984, "Guidelines for the Evaluation of the Response of Occupants of Fixed Structures, Especially Buildings and Off-shore Structures to Low-Frequency Horizontal Motion (0.063 to 1 Hz)" should be proposed as a national standard.

The following documents were received for vote by the U. S. Member Body:

(1) ISO/DIS 5349.2, Guidelines for The measurement and Assessment of Human Exposure to Hand-transmitted Vibrations. The final recommendation was for an affirmative vote, with comments submitted to ANSI on 19 November 1984.

(2) ISO/DIS 2631/2, Evaluation of Human Exposure to Whole-body Vibration—Part 2: Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80 Hz). Announced to S2 and S3 on 16 April 1985 with J. C. Barton coordinating comments and recommendations for vote.

(3) ISO/DP 8727–ISO/TC 108/SC4 N150—First Draft Proposal on Standard Biodynamic Coordinate System. A recommendation for a negative vote, with comments, was submitted to ANSI on 15 October 1984.

S2-65 Balancing Technology—*D. G. Stadelbauer, Chair* (counterpart to ISO/TC 108/SC1)

Several meetings of S2-65 have taken place since the last S2 meeting, in preparation for the September 1985 meeting of ISO/TC 108/SC1 in Vienna. The next meeting of S2-65 will be held in August 1985.

ANSI S2.43-1984 (ASA Catalog No. 50-1984), Criteria for Evaluating Flexible Rotor Balance, counterpart of international standard ISO 5343-1983 was published in 1984. At the S2 meeting, it was mentioned that two national standards were published in 1984, with potential for production of another two standards in 1985.

ISO/DP 8821, Rotor Shaft Key Convention on Balancing was voted on by the U. S. A. delegation. A recommendation for a positive U. S. A. position was forwarded to ANSI on 1 March 1985.

S2-66 Methods for Analyzing and Presenting Vibration and Shock Data—*J. C. Barton, Chair*

The international working group TC 108/WG8 was disbanded. Mr. Barton submitted the following report (for S2-66 and S2-67):

(1) The U. S. A. submitted a vote of approval, with comments, on ISO/DIS 8002—Mechanical Vibration of Land Vehicles—Methods for Reporting Measured Data.

(2) A revised draft of ISO/DP 8608—Mechanical Vibration—Road Surface Profiles—Reporting Measured Data has been received from Belgium. After minor editorial corrections, it is to be submitted to ISO for publication as a DIS.

(3) A new draft of France's proposed draft on the measurement and analysis of railway passenger and crew vibration has been received. The draft will be circulated for comment.

S2-67 Measurement and Evaluation of Vibration and Shock in Land Vehicles—*J. C. Barton, Chair* (counterpart to ISO/TC 108/SC2/WG4)

The international working group met in Edinburgh in September 1984.

S2-69 Seismic Testing—*G. E. Heberlein, Jr., Chair* (counterpart to IEC/SC50A/WG8)

The basic environmental testing procedure guide for testing seismic procedures is being reviewed by the international Working Group. U. S. comments on the international document were incorporated into the draft IEC/SC50A (Secretariat) 192.

S2-71 Techniques of Machinery Measurement—*R. J. Peppin, Chair*

Mr. Peppin has assumed Chairmanship of this working group which is being reorganized. A formal meeting is expected to be held before July 1985. His first order of business will be to update national standard ANSI S2.17-1980 entitled, Techniques of Machinery Vibration Measurement.

S2-73 Characteristics of Damping Materials—*L. C. Rogers, Chair* (counterpart to ISO/TC 108/WG 13)

TC 108/WG13 met in Berlin in September 1984. A revised document is being prepared for review by ISO/TC 108/WG 13 based on ISO/DP5405/2.

Mr. L. C. Rogers has assumed Chairmanship of this working group, both nationally and internationally. He has also prepared a first draft of an ANSI Standard entitled, Graphical Presentation of Damping Material Complex Modulus which will be presented at the TC 108/WG13 meeting to be held in September 1985.

S2-74 Measurement of Mechanical Mobility—*P. K. Baade, Chair* (counterpart to ISO/TC 108/WG14)

Part IV of the series of mobility standards ANSI S2.34-1984 entitled, Guide to the Experimental Determination of Rotational Mobility Properties and the Complete Mobility Matrix was approved and published.

Mr. Baade has reported that his working group has completed three of the five standards on mobility originally planned. Of the remaining two, one *is dormant for lack of interest and the other is being developed jointly with* the corresponding ISO Working Group (ISO/TC 108/WG14). This latter document is Part V of the series on mechanical mobility.

S2-76 Measurement and Evaluation of Machinery Vibration—*P. H. Maedel, Jr., Chair* (counterpart of ISO/TC 108/SC2/WG 1)

Two national standards were published during the past six months, namely:

(1) ANSI Standard S2.40-1984, Mechanical Vibration of Rotating and Reciprocating Machinery—Requirements for Instruments for Measuring Vibration Severity (counterpart of ISO 2954-1975) was published in 1984.

(2) ANSI Standard S2.41-1985, Mechanical Vibration of Large Rotating Machines with Speed Range from 10 to 200 rev/s—Measurement and Evaluation of Vibration Severity *In Situ* (counterpart of ISO 3945-1977).

Working Group S2-76 had several meetings since the October 1984 meeting of S2. A proposed ANSI version of a new ISO machinery vibration standard, as measured directly on the shaft, is being prepared and may be completed in 1985.

S2-77 Measurement and Evaluation of Ship Vibration—*E. Noonan, Chair* (counterpart to ISO/TC 108/SC2/WG2)

The following ISO Standards have been published in 1984:

ISO 4867-1984, Code for the Measurement and Reporting of Shipboard Vibration Data.

ISO 4868-1984, Code for the Measurement and Reporting of Local Vibration Data of Ship Structures and Equipment.

ISO 6954-1984, Guidelines for the Overall Evaluation of Vibration in Merchant Ships.

S2-77 plans to initiate action to draft an ANSI Standard, based on ISO 4867, within the next six months.

S2-78 Measurement and Evaluation of Structural Vibration—*S. Ying, Chair* (counterpart of ISO/TC 08/SC 2/WG3)

The corrections and comments proposed by S2-78 members at the ISO/TC108/SC2/WG3 meeting in Edinburgh were incorporated in the latest draft standard on building vibration.

S2-80 Vibration and Shock Terminology—*D. Muster, Chair* (counterpart to ISO/TC 108/WG1)

The counterpart of ISO 2041-1975, as revised, will be prepared for vote of S2 following ballot in TC 108.

Mr. Melnick, Chairman ASACOS, has stated at previous meetings *that the plan is for each of the S Committees to develop its own terminology,* in separate documents, with overall coordination with S1-8, and interaction with the chairman of each of the terminology Working Groups in the other S committees.

S2-81 Use and Calibration of Vibration and Shock Measuring Instruments—*B. Douglas, Chair* (counterpart to ISO/TC 108/SC3)

Two international documents, ISO/DIS 5347, Methods of Calibrating Vibration and Shock Pickups, and ISO/DIS 5348, Mechanical Mountings for Accelerometers (Seismic Pickups), are being prepared as national standards.

TC 108/SC3 met in Berlin in September 1984.

S2-86 Methods for Measuring and Reporting Vibration and Shock in Motion-Sensitive Equipment—*R. Frey, Chair* (counterpart to TC 108/WG16)

An initial meeting of this working group was held prior to the TC 108/WG16 in Edinburgh on September 1984.

The overall direction of ISO/TC 108/WG-16 has altered from one of vibration and shock sensitivity standards for sensitive equipment to one of setting up a standard for a uniform system to collect data in the field environment for such equipment. The data collected were used by equipment manufacturers in designing their products for the field environment. The equipment manufacturers represent at S2-86 and ISO/TC 108/WG meetings stated that such a data base on the vibration and shock field environment for computers and for electronic equipment is very desirable.

SHORT COURSES

NOVEMBER

MACHINERY INSTRUMENTATION AND DIAGNOSTICS

Dates: November 5-8, 1985
Place: Boston, Massachusetts
Dates: December 3-6, 1985
Place: Houston, Texas

Objective: This course is designed for industry personnel who are involved in machinery analysis programs. Seminar topics include a review of transducers and monitoring systems, machinery malfunction diagnosis, data acquisition and reduction instruments, and the application of relative and seismic transducers to various types of rotating machinery.

Contact: Customer Information Center, Bently Nevada Corporation, P.O. Box 157, Minden, NV 89423 - (702) 782-3611, Ext. 9242.

MACHINERY INSTRUMENTATION

Dates: November 12-14, 1985
Place: Calgary, Alberta, Canada

Objective: This seminar provides an in-depth examination of vibration measurement and machinery information systems as well as an introduction to diagnostic instrumentation. The three-day seminar is designed for mechanical, instrumentation, and operations personnel who require a general knowledge of machinery informa-tion systems. The seminar is a recommended prerequisite for the Machinery Instrumentation and Diagnostics Seminar and the Mechanical Engineering Seminar.

Contact: Customer Information Center, Bently Nevada Corporation, P.O. Box 157, Minden, NV 89423 - (702) 782-3611, Ext. 9243.

DECEMBER

VIBRATION AND SHOCK SURVIVABILITY, TESTING, MEASUREMENT, ANALYSIS, AND CALIBRATION

Dates: December 2-6, 1985
Place: Santa Barbara, California
Dates: February 3-7, 1986
Place: Santa Barbara, California
Dates: March 10-14, 1986
Place: Washington, DC
Dates: May 12-16, 1986
Place: Detroit, Michigan
Dates: June 2-6, 1986
Place: Santa Barbara, California
Dates: August 18-22, 1986
Place: Santa Barbara, California

Objective: Topics to be covered are resonance and fragility phenomena, and environmental vibration and shock measurement and analysis; also vibration and shock environmental testing to prove survivability. This course will concentrate upon equipments and techniques, rather than upon mathematics and theory.

Contact: Wayne Tustin, 22 East Los Olivos Street, Santa Barbara, CA 93105 -(805) 682-7171.

FEBRUARY

MACHINERY VIBRATION ANALYSIS

Dates: February 11-14, 1986
Place: Orlando, Florida
Dates: August 19-22, 1986
Place: New Orleans, Louisiana
Dates: November 11-14, 1986
Place: Chicago, Illinois

Objective: This course emphasizes the role of vibrations in mechanical equipment instrumentation for vibration measurement, techniques for vibration analysis and con-

trol, and vibration correction and criteria. Examples and case histories from actual vibration problems in the petroleum, process, chemical, power, paper, and pharmaceutical industries are used to illustrate techniques. Participants have the opportunity to become familiar with these techniques during the workshops. Lecture topics include: spectrum, time domain, modal, and orbital analysis; determination of natural frequency, resonance, and critical speed; vibration analysis of specific mechanical components, equipment, and equipment trains; identification of machine forces and frequencies; basic rotor dynamics including fluid-film bearing characteristics, instabilities, and response to mass unbalance; vibration correction including balancing; vibration control including isolation and damping of installed equipment; selection and use of instrumentation; equipment evaluation techniques; shop testing; and plant predictive and preventive maintenance. This course will be of interest to plant engineers and technicians who must identify and correct faults in machinery.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

MARCH

MEASUREMENT SYSTEMS ENGINEERING
Dates: March 10-14, 1986
Place: Phoenix, Arizona
MEASUREMENT SYSTEMS DYNAMICS
Dates: March 17-21, 1986
Place: Phoenix, Arizona
Objective: Electrical measurements of mechanical and thermal quantities are presented through the new and unique "Unified Approach to the Engineering of Measurement Systems." Test requestors, designers, theoretical analysts, managers and experimental groups are the audience for which these programs have been designed. Cost-effective, valid data in the field and in the laboratory, are emphasized. Not only how to do that job, but how to tell when it's been done right.

Contact: Peter K. Stein, Director, 5602 East Monte Rosa, Phoenix, AZ 85018 - (602) 945-4603; (602) 947-6333.

JULY

ROTOR DYNAMICS
Dates: July 14-18, 1986
Place: Rindge, New Hampshire
Objective: The role of rotor/bearing technology in the design, development and diagnostics of industrial machinery will be elaborated. The fundamentals of rotor dynamics; fluid-film bearings; and measurement, analytical, and computational techniques will be presented. The computation and measurement of critical speeds vibration response, and stability of rotor/bearing systems will be discussed in detail. Finite elements and transfer matrix modeling will be related to computation on mainframe computers, minicomputers, and microprocessors. Modeling and computation of transient rotor behavior and nonlinear fluid-film bearing behavior will be described. Sessions will be devoted to flexible rotor balancing including turbogenerator rotors, bow behavior, squeeze-film dampers for turbomachinery, advanced concepts in troubleshooting and instrumentation, and case histories involving the power and petrochemical industries.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

AUGUST

VIBRATIONS OF RECIPROCATING MACHINERY
Dates: August 19-22, 1986
Place: New Orleans, Louisiana
Objective: This course on vibrations of reciprocating machinery includes piping and

foundations. Equipment that will be addressed includes reciprocating compressors and pumps as well as engines of all types. Engineering problems will be discussed from the point of view of computation and measurement. Basic pulsation theory --including pulsations in reciprocating compressors and piping systems -- will be described. Acoustic resonance phenomena and digital acoustic simulation in piping will be reviewed. Calculations of piping vibration and stress will be illustrated with examples and case histories. Torsional vibrations of systems containing engines and pumps, compressors, and generators, including gearboxes and fluid drives, will be covered. Factors that should be considered during the design and analysis of foundations for engines and compressors will be discussed. Practical aspects of the vibrations of reciprocating machinery will be emphasized. Case histories and examples will be presented to illustrate techniques.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

SEPTEMBER

MODAL TESTING OF MACHINES AND STRUCTURES

Dates: September 8-11, 1986
Place: Chicago, Illinois
Objective: Vibration testing and analysis associated with machines and structures will be discussed in detail. Practical examples will be given to illustrate important concepts. Theory and test philosophy of modal techniques, methods for mobility measurements, methods for analyzing mobility data, mathematical modeling from mobility data, and applications of modal test results will be presented.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

NEWS BRIEFS: news on current and Future Shock and Vibration activities and events

4th INTERNATIONAL MODAL ANALYSIS CONFERENCE
February 3-6, 1986
Los Angeles, California

The 4th International Modal Analysis Conference will be held at the Los Angeles Airport Marriott Hotel, Los Angeles, California on February 3-6, 1986. IMAC is the only conference devoted exclusively to the modern technology of modal testing and analysis relating to structural dynamics. More than 200 technical papers from 23 countries will be presented, dealing with both analytical and experimental methods in modal analysis. A comprehensive exhibit of modern modal analysis and testing hardware, software and peripherals will be shown by leading firms. The IMAC Conference is sponsored by Union College with the cooperation of the Polytechnic Institute of New York.

A three-day intensive course covering modal analysis and testing technology will be held directly prior to the IMAC Conference. The course titled, "Modal Analysis: Theory and Application," with emphasis on utilization of commercially available hardware and software, will be held January 30 -February 1, 1986 at the Los Angeles Airport Marriott Hotel. This course is directed toward those who are contemplating or are directly working in this field.

For further information contact: Ms. Rae D'Amelio, Union College, Wells House, Schenectady, NY 12308 - (518) 370-6288.

SYMPOSIUM ON DYNAMIC BEHAVIOR OF COMPOSITE MATERIALS, COMPONENTS AND STRUCTURES
June 8-12, 1986
New Orleans, Louisiana

A symposium on Dynamic Behavior of Composite Materials, Components and Structures will be held at the 1986 Spring Meeting of the Society for Experimental Mechanics (SEM) on June 8-12, 1986 in New Orleans, Louisiana. The symposium is co-sponsored by the SEM Composite Materials Committee and the SEM Modal Analysis/Dynamic Systems Committee.

Twelve invited papers are to be presented on topics such as an overview of recent research, dynamic behavior of composites in machinery, modal analysis of composite structures, damping characteristics of new polymer matrix and metal matrix composites, aeroelastic behavior of composite aircraft wings, delamination of composite laminates under impact, damage characterization with dynamic measurements, and rate sensitivity of energy absorbing composites.

For further information contact: R.F. Gibson, Mechanical Engineering Dept., University of Idaho, Moscow, ID 83843 - (208) 885-7432.

ABSTRACTS FROM THE CURRENT LITERATURE

ABSTRACT CONTENTS

AVAILABILITY OF PUBLICATIONS ABSTRACTED

None of the publications are available at SVIC or at the Vibration Institute, except those generated by either organization.

Periodical articles, society papers, and papers presented at conferences may be obtained at the Engineering Societies Library, 345 East 47th Street, New York, NY 10017; or Library of Congress, Washington, D.C., when not available in local or company libraries.

Government reports may be purchased from National Technical Information Service, Springfield, VA 22161. They are identified at the end of bibliographic citation by an NTIS order number with prefixes such as AD, N, NTIS, PB, DE, NUREG, DOE, and ERATL.

Ph.D. dissertations are identified by a DA order number and are available from University Microfilms International, Dissertation Copies, P.O. Box 1764, Ann Arbor, MI 48108.

U.S. patents and patent applications may be ordered by patent or patent application number from Commissioner of Patents, Washington, D.C. 20231.

Chinese publications, identified by a CSTA order number, are available in Chinese or English translation from International Information Service, Ltd., P.O. Box 24683, ABD Post Office, Hong Kong.

Institution of Mechanical Engineers publications are available in U.S.: SAE Customer Service, Dept. 676, 400 Commonwealth Drive, Warrendale, PA 15096, by quoting the SAE-MEP number.

When ordering, the pertinent order number should always be included, not the **DIGEST** abstract number.

A List of Periodicals Scanned is published in issues, 1, 6, and 12.

MECHANICAL SYSTEMS

ROTATING MACHINES

85-2003
Radial and Tangential Flow Fans Instead of Axial Flow Fans for the Use in Cooling Systems of Vehicles with Internal Combustion Engines
R. von Hofe, G.E. Thien
Automobiltech. Z., 87 (4), pp 157-163 (Apr 1985), 12 figs, 12 refs (In German)

KEY WORDS: Fans, Cooling systems, Automobiles, Noise generation

For vehicles with high engine performance and space available for installation of cooling systems the noise of axial flow fans even in an optimized version may be too high. Uneven air flow through the radiator core is a problem arising with radiators of small height and large width combined with an axial flow fan in close arrangement. Radial and tangential flow fans were studied to determine which are better suited for such cases.

85-2004
An Efficient Approach to Design Low-Noise Automotive Cooling Systems
R. von Hofe, G.E. Thien
AVL List GmbH, Graz, Austria
Vehicle Noise and Vibration, Institution of Mech. E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 31-40, 8 figs, 1 table, 10 refs

KEY WORDS: Fans, Cooling systems, Automobile engines, Noise reduction, Design techniques

Reduction of noise radiated by a vehicle requires treatment of all dominant sources, one being the cooling system of the engine. The noise emitted by the cooling fan is influenced by various components of the cooling system and by those parts of the vehicle representing obstacles in the air flow. The paper is based on a research work investigating all influencing parameters in many variations.

85-2005
Rotor/Body Aerodynamic Interactions
M.D. Betzina, C.A. Smith, P. Shinoda
NASA Ames Res. Ctr., Moffett Field, CA 94035
Vertica, 9 (1), pp 65-81 (1985), 27 figs, 2 tables, 12 refs

KEY WORDS: Helicopter rotors, Aerodynamic loads, Wind tunnel testing

A wind-tunnel investigation was conducted in which independent, steady-state aerodynamic forces and moments were measured on a 2.24-m-dia, two-bladed helicopter rotor and on several different bodies. The objective was to determine the mutual interaction effects for variations in velocity, thrust, tip-path-plane angle of attack, body angle of attack, rotor/body position, and body geometry.

85-2006
An Aerodynamic Theory Based on Time-Domain Aeroacoustics
L.N. Long
Lockheed-California Co., Burbank, CA
AIAA J., 23 (6), pp 875-882 (June 1985), 10 figs, 26 refs

KEY WORDS: Propellers, Rotors, Aerodynamic noise

The aerodynamics of propellers and rotors is especially complicated because of the highly three-dimensional and compressible nature of the flowfield. However, when linearized theory is applicable, the problem is governed by the wave equation, and a numerically efficient integral formulation can be derived. This reduces the problem from on in space to one over a surface. Many such formulations exist in the aeroacoustics literature, but these become singular integral equations if one naively tries to use them to predict surface pressures, i.e., for aerodynamics. The present paper illustrates how one must interpret these equa-

tions in order to obtain nonambiguous results.

85-2007
Programmable Calculator Becomes the Mechanic's Alignment Tool
R.L. Curfman
AMOCO Chemicals Corp., Alvin, TX
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 7-14, 4 figs, 4 refs

KEY WORDS: Alignment, Computer-aided techniques, Rotors

The purpose of this paper is to illustrate how a team effort improved rotating equipment alignment practices and reduced maintenance costs in a large petrochemical complex by use of a programmable calculator as a mechanic's tool.

85-2008
Aligning Cooling Tower Drive Systems
J. Piotrowski
General Electric Co., Evendale, OH
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 31-36, 8 figs, 1 ref

KEY WORDS: Shafts, Alignment, Cooling towers

Rotating equipment with shafts spaced a considerable distance apart connected by a rigid coupling spool piece such as found on cooling tower fan drives are fairly easy to align if the proper technique is used. A new shaft alignment technique similar to the reverse indicator method commonly used to align machinery is shown for these types of drive systems.

85-2009
Estimating the Severity of Sub-Synchronous Shaft Vibrations within Fluid Film Journal Bearings
J.D. McHugh
General Electric Co., Schenectady, NY
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 29-40, 15 figs, 3 refs

KEY WORDS: Shafts, Subsynchronous vibrations, Journal bearings

Frequency analyzers sometimes show that shaft proximity probe signals have both a subsynchronous and synchronous component. For shafts supported on fluid-film bearings, a widely-held concern exists over any subsynchronous vibrations, even when the levels are limited in magnitude. Little information has existed for judging the impact of such vibrations on the bearing. A rational method is developed for estimating the dynamic load imposed on a bearing by combinations of sub-synchronous and synchronous vibration. Curves are provided for several bearing geometries which can be used to estimate the maximum dynamic load produced by such vibrations.

85-2010
Super-Summed-and-Differential Harmonic Oscillations in a Symmetrical Rotating Shaft System
T. Yamamoto, Y. Ishida, T. Ikeda
Nagoya Univ., Chikusa-ku, Nagoya-city, Japan
Bull. JSME, 28 (238), pp 679-686 (Apr 1985), 9 figs, 1 table, 13 refs

KEY WORDS: Shafts, Sum and difference frequencies

Discussions are made on super-summed-and-differential harmonic oscillations in a symmetrical rotating shaft system (a system consisting of an elastic shaft with circular cross section and a disc) with nonlinear spring characteristics. The probability of occurrence and the shapes of resonance curves are investigated, with special attention to nonlinear components represented by polar coordinates.

85-2011
Visualization of Dynamic Forces in Rotating Machinery
J.D. Halloran
Joy Manufacturing Co.
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 1-9, 14 figs, 4 refs

KEY WORDS: Rotating machinery, Dynamic force analysis

Diagrams of dynamic forces present in rotating machinery are presented and discussed. This type of physical representation provides a pictorial understanding of the vibration mechanisms that occur in rotating machinery. The visualizations developed are intended to be supplemental to the more typical mathematical treatments of the same subject.

85-2012
Subsynchronous Vibrations in a High Pressure Centrifugal Compressor: A Case History
B.B. Evans, A.J. Smalley
Southwest Res. Inst., San Antonio, TX 78284
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 51-60, 22 figs, 1 table, 8 refs

KEY WORDS: Centrifugal compressors, Subsynchronous vibrations, Case histories, Vibration control, Structural modification

Two distinct aerodynamically excited vibrations in a high pressure low flow centrifugal compressor are documented. A measured vibration near 21 percent of running speed was identified as a non-resonant forced vibration resulting from rotating stall in the diffuser; a measured vibration near 50 percent of running speed was identified as a self-excited vibration sustained by cross-coupling forces acting at the compressor wheels.

85-2013
A New Approach in the Simulation of Crankshaft Torsional Vibration
D.F. Kabele
John Deere Product Engrg. Ctr., Waterloo, IA
Vehicle Noise and Vibration, Institution of Mech.E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 131-140, 3 figs, 15 refs

KEY WORDS: Crankshafts, Torsional vibrations

A model for simulation of crankshaft torsional vibration is derived from Newtonian Mechanics. Features of the model include piston and ring friction, connecting rod plane motion, hysteretic damping in the crankshaft, and cylinder pressure as a forcing function. The theory of the model and comparison with experimental measurements are presented.

RECIPROCATING MACHINES

85-2014
Vibration Characteristics of an In-Line Engine Structure
G.L. Turner, M.G. Milsted, P. Hanks
Koninklijke/Shell Exploratie en Produktie Laboratorium, The Hague
Vehicle Noise and Vibration, Institution of Mech. E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 161-171, 8 figs, 1 table, 7 refs

KEY WORDS: Engine cylinder blocks, Modal analysis, Vibration prediction, Substructuring methods

A finite element analysis is used to investigate the broad band vibration behavior of an in-line engine cylinder block. Point and transfer mobilities at the main bearings and between the bearings and the side walls are calculated using a truncated modal analysis procedure which allows forces to be applied at slave freedoms.

85-2015
Experimental Techniques Leading to the Better Understanding of the Origins of Automotive Engine Noise
T. Priede, J. Dixon, E.C. Grover, N.A. Saleh
Inst. of Sound and Vibration Res., Southampton Univ., UK
Vehicle Noise and Vibration, Institution of Mech.E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 141-159, 10 figs, 2 tables, 10 refs

KEY WORDS: Engine noise, Noise generation

The success of theoretical engine noise prediction using such techniques as finite element modeling is highly dependent upon the understanding of the various mechanisms of noise generation in the running engine. Specific rig tests, both static and dynamic, developed to simulate individually major noise producing mechanisms are described. Tests include gas force simulation by both explosive and hydraulic methods, mechanical impact simulation of both piston slap and bearing impacts, and impulsive loading of the various structural elements of the engine.

85-2016
Cars with Closed Engine Compartment — Effect Upon Exterior Noise and Passenger Comfort
G.E. Thien, F.K. Brandl, K. Kirchweger, E. Winklhofer
AVL List GmbH, Graz, Austria
Vehicle Noise and Vibration, Institution of Mech.E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 121-130, 8 figs, 20 refs

KEY WORDS: Engine noise, Noise reduction

A complete enclosure of the power unit represents an efficient approach to reducing the exterior noise of vehicles. An economic solution for passenger cars is to close the engine compartment in a sound proof manner. Other possibilities of engine noise reduction are discussed.

85-2017
Determining Noise Radiation of a Diesel Engine Due to Bearing Excitation Using Analytical and Experimental Techniques
J.P. Brandeis, J. Graison
Regie Renault, Reuil-Malmaison Cedex, France
Vehicle Noise and Vibration, Institution of Mech. E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 173-188, 13 figs, 6 refs

KEY WORDS: Diesel engines, Noise generation, Noise reduction, Structural modification techniques

The noise generation of a diesel engine is determined and static and dynamic finite element analyses are presented, correlated with experimental work, to achieve proper structure modifications and provide effective noise reductions.

85-2018
Measuring Diesel Noise at Source with a View to Its Control
M.F. Russell, D.C. Palmer, C.D. Young
Lucas CAV Limited, Acton, London
Vehicle Noise and Vibration, Institution of Mech. E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 97-105, 10 figs, 17 refs

KEY WORDS: Diesel engines, Noise measurement, Noise control

A comparison between the filter response of a combustion noise meter and the structure response spectra of eight automotive diesel engines indicates that such a meter can provide acceptable measurements for a wide variety of engines. The applications for such a meter are illustrated by measurements of the increase in combustion noise which accompanies a degradation in fuel ignition quality. A similar approach is discussed for measuring the noise due to piston slap, and a simple method for calibrating piston slap transducers is described. The applications for this measurement technique are illustrated by results for oil-cushion pistons.

85-2019

Vibration Mode Analysis of Engine Components Using Double Pulsed Laser Holography

Y. Miura, T. Susuki

Hino Motors Limited, Tokyo, Japan

Vehicle Noise and Vibration, Institution of Mech. E, London Conf. Pub. 1984-5, SAE-MEP 198, pp 257-267, 16 figs, 2 tables, 6 refs

KEY WORDS: Diesel engines, Mode shapes, Holographic techniques, Lasers

A vibration mode analysis, using double pulsed laser holography for the purpose of obtaining a lower level of noise emission from an automotive diesel engine, is described. The vibration pattern obtained is useful for understanding vibration phenomena of a wide area of the engine surface. The pattern is generated as a series of interference fringes joining points vibrating with equal amplitudes.

85-2020

Noise Reduction Possibilities in Axial Reciprocating Pumps (Möglichkeiten der Lärmminderung bei Axialkolbenpumpen)

W. Kollek, C.M. Lang

Konstruktion, 37 (4), pp 141-144 (Apr 1985), 10 figs, 3 refs (In German)

KEY WORDS: Reciprocating pumps, Noise reduction

The noise level of hydraulic components depends on their construction, design, and operational parameters. Since axial reciprocating pumps are major contributors to noise emission, passive noise reduction methods are very valuable. The effect of operational parameters of viscosity, shaft speed, capacity, lifting pressure pulsation, operating pressure, etc., on noise pressure level are described.

85-2021

Vibration Analysis and Correction of an Off-Gas Reciprocating Compressor — A Case History

R.L. Eshleman, R.E. Williams

Vibration Institute, Clarendon Hills, IL

Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 81-86, 16 figs

KEY WORDS: Reciprocating compressors, Case histories, Vibration control, Supports

This paper concerns the correction of high vibration on a 23 1/2 x 13 x 6 3/4 x 9 three stage double acting off-gas reciprocating compressor installation. Failures were experienced in the compressor bearings and support structure. Vibration tests on the facility and a mathematical analysis of the compressor forces and support structure showed excessive vibration of the compressor unit due to inadequate structural support between the compressor and its foundation, which was of adequate size. The high amplitude vibration of the compressor, piping, structural support, and adjacent grating was caused by compressor gas forces being amplified in the compressor structural support.

METAL WORKING AND FORMING

85-2022

Automated Chatter Suppression by Tool Geometry Control

C.R. Liu, T.M. Liu

Purdue Univ., West Lafayette, IN 47906

J. Engrg. Indus., Trans. ASME, 107 (2), pp 95-98 (May 1985), 6 figs, 1 table, 6 refs

KEY WORDS: Machine tools, Chatter, Vibration control, Geometric effects

A new concept of controlling tool geometry for in-process chatter suppression is quantitatively evaluated. Experimentally derived relationships between machining stability and tool geometry; namely, rake angle, clearance angle, and side cutting angle are developed. The results indicate an order of magnitude increase in the production rate if the control method is properly used.

85-2023

An Analytical Model of Cutting Dynamics. Part 1: Model Building

D.W. Wu, C.R. Liu

Univ. of Illinois, Chicago, IL 60680

J. Engrg. Indus., Trans. ASME, 107 (2), pp 107-111 (May 1985), 4 figs, 1 table, 17 refs

KEY WORDS: Machine tools, Chatter, Mathematical models

A mathematical model of machining chatter has been developed through an analytical approach in order to predict dynamic cutting force from steady-state cutting tests. The model is derived from a pseudo-static geometric configuration of the cutting process by taking into account that mean friction coefficient fluctuates dynamically responding to variation of the relative speed on the chip-tool interface. The force functions through this derivation can be used to explain all three basic mechanics associated with chatter vibration; namely, velocity dependent, regenerative, and mode coupling effects.

85-2024

An Analytical Model of Cutting Dynamics. Part 2: Verification

D.W. Wu, C.R. Liu

Univ. of Illinois, Chicago, IL 60680

J. Engrg. Indus., Trans. ASME, 107 (2), pp 112-118 (May 1985) 10 figs, 1 table, 12 refs

KEY WORDS: Machine tools, Cutting

The dynamic force model developed in a preceding paper is further examined. The analysis shows a successful prediction of the forms of stability boundary over a wide range of cutting speed. It reveals that the cutting force acting on tool rake face controls the high-speed stability, while the ploughing for acting on tool nose region dominates the low-speed stability. A series of cutting tests were carried out to examine the validity of the model.

85-2025

Cutting Dynamics Identification by Dynamic Data System (DDS) Modeling Approach

T.Y. Ahn, K.F. Eman, S.M. Wu

Univ. of Wisconsin, Madison, WI 53706

J. Engrg. Indus., Trans. ASME, 107 (2), pp 91-94 (May 1985), 4 figs, 1 table, 11 refs

KEY WORDS: Cutting, Machine tools, Dynamic data system technique

The dynamics of the cutting process have been conventionally characterized in terms of the dynamic cutting force coefficients which represent its transfer characteristics at discrete frequencies. However, this approach fails to obtain the transfer function of the process in closed analytical form. Anticipating the stochastic nature of the cutting process and the double modulation principle, a two-input one-output multivariate system was postulated for the dynamic cutting process identification model. The dynamic data system (DDS) methodology was used to formulate and characterize the dynamic cutting process using modified autoregressive moving average vector models.

85-2026

Identification of the Transfer Function of Dynamic Cutting Processes - A Comparative Assessment

T.Y. Ahn, K.F. Eman, S.M. Wu

Univ. of Wisconsin, Madison, WI

Intl. J. Mach. Tool Des. Res., 25 (1), pp 75-90 (1985), 11 figs, 3 tables, 19 refs

KEY WORDS: Cutting, Transfer functions, Dynamic data system technique

A method is introduced for the determination of the cutting process transfer function in the form of analytical models based on experimental data. The Dynamic Data System (DDS) approach has made it possible to adequately characterize the dynamic cutting process from observations of random force and vibration components. The theoretical concepts and modelling procedure are demonstrated using actual experimental data.

85-2027

Vibration Control Principles in Machine Tools

A.K. Rakhit
Reliance Electric Co., Greenville, SC
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 95-103, 12 figs, 6 refs

KEY WORDS: Machine tools, Vibration control, Stiffness coefficients, Damping coefficients

In the design of any rotating machinery, it is important to consider both static and dynamic stiffnesses of the machine structure to ensure stability. The paper reviews several methods of increasing static and dynamic stiffnesses and also highlights some practical methods of damping mechanisms that can easily be installed in a machine.

MATERIALS HANDLING EQUIPMENT

85-2028
Selecting and Applying Vibrating Conveyors
H. Colijn
H. Colijn & Associates, Monroeville, PA
Plant Engrg., 38 (17), pp 60-61 (July 26, 1984), 5 figs

KEY WORDS: Conveyors, Vibratory techniques

Vibratory or oscillating conveyors, used for handling a wide variety of granular bulk materials, often in concert with processing equipment, are discussed.

STRUCTURAL SYSTEMS

BUILDINGS

85-2029
Free Vibration of a Shearwall-Frame Building on an Elastic Foundation
T. Balendra
National Univ. of Singapore, Singapore 0511
J. Sound Vib., 96 (4), pp 437-446 (Oct 22, 1984) 6 figs, 2 tables, 11 refs

KEY WORDS: Buildings, Elastic foundations, Natural frequencies, Mode shapes, Rayleigh-Ritz method

The frequencies and associated mode shapes of a shearwall-frame building interacting with an elastic foundation are determined by using an iterative technique with the Rayleigh-Ritz method. The eigenfunctions of a clamped-free prismatic shear-flexure beam are suitably modified to generate the required shape functions. The influence of the soil on the frequency spectrum of a shearwall-frame building is investigated.

85-2030
Response Measurements for Two Building Structures Excited by Noise from a Large Horizontal Axis Wind Turbine Generator
H.H. Hubbard, K.P. Shepherd
College of William and Mary, Williamsburg, VA
Rept. No. NASA-CR-172482, 25 pp (Nov 1984), N85-13552/3/GAR

KEY WORDS: Buildings, Noise-induced excitation, Turbogenerators

Window and wall acceleration measurements and interior noise measurements are made for two different building structures during excitation by noise from WTS-4 horizontal axis wind turbine generator operating in a normal power generation mode.

85-2031
The Feasibility of the Standard Presentation of Structure-Borne Sound Transmission at Rigid Rectangular Plate-Discontinuities (Möglichkeiten der normierten Darstellung von Körperschall-Transmissionsgraden an starren rechtwinkligen Plattenstossstellen)
W. Wöhle, H. Schreckenbach, E. Bieber
Technische Universität Dresden, Sektion Informationstechnik, DDR
Acustica, 57 (3), pp 149-157 (March 1985), 14 figs, 7 refs (In German)

KEY WORDS: Buildings, Structure-borne noise, Joints

For calculating the propagation of structure-borne sound in buildings it is necessary to know the transmission efficiencies at rectangular structural slab-joints for the diffuse incidence of sound. Some parts of the structure-borne sound energy are transformed into different wave-types (bending, longitudinal and transverse waves) at these junctions. Using statistical energy analysis for the calculation of the sound propagation the coupling-loss factors are calculated from the transmission efficiencies. Based on a well-known method for calculating the transmission and reflection efficiencies for diffuse sound incidence, it is possible to represent these transmission or reflection efficiencies for stiff-coupled structural slab joints, with identical slabs, as a function of a normalized frequency.

TOWERS

85-2032

Control of a Wind Induced Stack Vibration Using a Damped Guy System

J.E. Corley

Arabian American Oil Co., Dhahran, Saudi Arabia

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 87-93, 11 figs, 3 refs

KEY WORDS: Chimneys, Nuclear power plants, Wind-induced excitation, Vortex shedding, Dampers

A wind-induced vibration problem on several large exhaust stacks in an NGL plant is described. The stacks were excited by vortex shedding at moderate wind levels which resulted in fatigue damage and cracking. The design of a damper system that reduced the vibration amplitudes to acceptable levels is discussed. The instrumentation system and some of the analysis techniques used to analyze the random vibration excitation are also described.

FOUNDATIONS

85-2033

Visco-Damage Tension Model for Rocks in Ground-Shock Applications

L. Whitman

Weidlinger Associates, 333 Seventh Ave., New York, NY

Intl. J. Numer. Anal. Methods Geomech., 9 (1), pp 71-89 (Jan/Feb 1985), 6 figs, 2 tables, 23 refs

KEY WORDS: Rocks, Tensile strength, Ground shock

A simple rate-dependent tension model, tailored primarily for rocks in ground-shock calculations, has been constructed. It is formulated as an internal state variable theory with spherical void development taken to approximate the underlying dissipative micromechanism. This simplifying assumption of ductile, rather than brittle, damage growth has been made to enhance the practicality of the model for large-scale problem. The model has been restated within the framework of (strain-softening) viscoplasticity to associate it with the desirable mathematical properties of the latter theory

85-2034

Simplified Calculation Method and Its Programming for Horizontal Stiffness of Group Piles Under Seismic Action

Wang Youwei, Wang Kaishun

China Civ. Engrg. J., 17 (1), pp 38-48 (1984), CSTA No. 624-84.31

KEY WORDS: Pile structures, Seismic response, Computer programs

After a study of existing calculation methods under seismic action, a simplified method for the calculation of the horizontal stiffness of group piles is proposed. Computer programs are also included.

85-2035

A Free-Vibrating Column Test in Soil Dynamics

Gu Yaozhang
China Civ. Engrg. J., 17 (2), pp 29-46 (1984), CSTA No. 624-84.37

KEY WORDS: Soils, Dynamic tests, Resonant column tests

The free-vibrating column test is a new technique for measuring the dynamic parameters of soil. The test is controlled by a microcomputer-based system including electric converters. The history of the resonant column test as a base of the free-vibrating column test is reviewed and compared.

HARBORS AND DAMS

85-2036
Dynamic Response Analysis of Embankment Dams
A.K. Chugh
U.S. Dept. of the Interior, Denver, CO 80225
Intl. J. Numer. Anal. Methods Geomech., 9 (2), pp 101-124 (Mar/Apr 1985), 16 figs, 1 table, 33 refs

KEY WORDS: Dams, Earthquake response, Wave propagation, Finite element technique

A one-dimensional wave propagation method for earthquake response analysis of horizontally-layered sites of infinite lateral extent is adapted to account for the finite cross-sectional dimensions of an embankment dam. This is overlying a foundation deposit which may be considered infinite in its lateral extent. The procedure is used to study the response of an existing embankment dam for an actual earthquake record. A two-dimensional dynamic finite element analysis is also performed for this case.

ROADS AND TRACKS

85-2037
Measurement and Prediction of Impact Loads from Worn Railroad Wheel and Rail Surface Profiles
D.R. Ahlbeck, J.A. Hadden
Battelle-Columbus Labs., Columbus, OH 43201
J. Engrg. Indus., Trans. ASME, 107 (2), pp 197-205 (May 1985), 13 figs, 18 refs

KEY WORDS: Rail-wheel interaction

The effects of wheel/rail impact loads are particularly important in the design and use of modern concrete-tie track structures. The development of a computer model for predicting impact loads due to wheel or rail running-surface geometry errors is described.

VEHICLE SYSTEMS

GROUND VEHICLES

85-2038
A Study of Automatic Transmission Vehicle Drive-By Noise Characteristics
D. Morrison
Ricardo Consulting Engineers plc, Shoreham-by-Sea, Sussex
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 7-19, 9 figs, 5 tables, 13 refs

KEY WORDS: Automobiles, Noise generation

A study of automatic transmission cars with respect to urban driving characteristics and drive-by noise levels is described. A survey of published data on automatic transmissions is included.

85-2039
Future Trends in Noise Legislation for Road Vehicles
B.V. Woolford
Dept. of Transport, Vehicle Standards and Engrg. Div., 2 Marsham St., London SW1, UK
Vehicle Noise and Vibration, Instn. Mech.

Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 1-6, 2 figs, 2 tables, 10 refs

KEY WORDS: Ground vehicles, Noise generation, Regulations

The noise of road vehicles has received the attention of legislators in the UK and elsewhere for many years. Proposals of the European Commission for further reductions in the limits for most vehicles are now before the Council. This paper gives the background to noise legislation and the latest proposals of the Commission.

85-2040

Variability of Interior Noise Levels in Passenger Cars

L.A. Wood, C.A. Joachim
Royal Melbourne Inst. of Technology and General Motors - Holden's Limited, Melbourne, Australia

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 197-206, 8 figs, 15 refs

KEY WORDS: Ground vehicles, Interior noise, Sound waves, Wave scattering

Noise level scatter, often 10 dB or more in nominally identical motor vehicles, is assessed in terms of structural-acoustic characteristics. Potential sources of this troublesome scatter are reviewed.

85-2041

Quiet Heavy Vehicles - the QHV 90 Project

C.G.B. Mitchell
Transport and Road Res. Lab., Crowthorne, Berkshire

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 41-44, 1 fig, 2 tables, 17 refs

KEY WORDS: Ground vehicles, Noise reduction, Cargo vehicles

The Government has launched a joint project with industry - QHV 90 - to conduct research and to support the design, development, construction and testing of prototype heavy goods vehicles, engines and system components to meet the more rigorous noise limits that are likely to be in force by 1990. This paper describes the factors influencing the definition of the QHV 90 project, outlines the content of the project, and discusses some of the technical issues raised by reducing the noise of heavy goods vehicles.

85-2042

Laminated Steel for Car Body Panels — a Lightweight Noise Control Method?

B.R. Johansson
Antiphon International AB, Sundyberg, Sweden

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 227-234, 14 figs, 7 refs

KEY WORDS: Automobiles, Acoustic insulation, Steel

By using laminated steel in car bodies both the airborne sound isolation properties and the structure borne sound damping properties are shown to be improved with a very small weight increase.

85-2043

Analysis Technique for Vehicle Shake

C.W. Barson, J.C. Walker
Tyre Tech. Div., Dunlop Limited, Birmingham, UK

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 47-54, 10 figs, 1 table, 4 refs

KEY WORDS: Ground vehicles, Tire-wheel interaction, Vibration measurement

Vibrations of a vehicle occurring at road wheel rotation frequency are a major problem for the tire engineer. Methods of detecting the various sources of shake are made difficult by the beating between them. This paper gives details of a technique developed to obtain reliable measurements of the contribution of the tires, the wheels, the fit tolerances and the vehicle to the shake vibrations. The method is ex-

tended to produce the complex transmission factors, both direct and cross-coupling, between the forces generated by tire and wheel nonuniformity or imbalance, and important parts of the vehicle body.

85-2044
Modelling a Seat-Person System in the Vertical and Fore-and-Aft Axes
T.E. Fairley, M.J. Griffin
Inst. of Sound and Vib. Res., The Univ. of Southampton
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 83-89, 7 figs, 5 refs

KEY WORDS: Ground vehicles, Automobile seats

The optimization of seats requires dynamic models of the seat-person system for both the vertical (z-) and fore-and-aft (x-) axes. The z-axis apparent masses of ten men sitting on a flat seat, feet-supported and feet-not-supported, have been measured. The mean results are compared with International Standard ISO 5982 (1981) which is used to predict the z-axis transmissibility of a seat. The x-axis transmissibility of a seat with an x-axis isolation mechanism was measured and a simple model of the x-axis seat-person system is illustrated.

85-2045
A Numerical Technique for Theoretical Analysis of Transmission Systems
M.M.A. Shahin
University College of Swansea, UK
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 107-111, 4 figs, 1 table, 3 refs

KEY WORDS: Ground vehicles, Computer programs, Power transmission systems, Resonant response

A mathematical model was built and a comprehensive computer program was developed to simulate, approximately, a drive line of a vehicle. The technique was tested and then used to examine the effect of driving torque and driving speed on the initiation of a resonant transient vibration.

85-2046
Structural Design Analysis of Commercial Vehicle Cabs
R.J. Amos
National Engineering Laboratory, East Kilbride, Glasgow
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 217-226, 8 figs, 7 tables, 8 refs

KEY WORDS: Trucks, Design techniques, Computer programs, Finite element technique

The application of advanced structural analysis in design is discussed. The development of validated NASTRAN finite element models of a commercial vehicle cab structure and associated modeling techniques aimed at predicting displacements and stress under static and dynamic loads, modal properties and fatigue life is investigated.

85-2047
The Mechanics of Axle Tramping Vibrations
R.S. Sharp
Univ. of Leeds, UK
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 113-120, 8 figs, 4 refs

KEY WORDS: Axles, Self-excited vibrations, Braking effects

The motions of the model system are obtained by digital simulation, and the model is shown to be capable of representing axle tramping vibrations in their most basic form.

85-2048
Off-road Vehicle Ride Vibration
D.A. Crolla, D.L. Horton, A.K. Dale
Univ. of Leeds, UK
Vehicle Noise and Vibration, Instn. Mech.

Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 55-64, 6 figs, 5 tables, 21 refs

KEY WORDS: Off-road vehicles, Vibration measurement

The particular problems associated with off-road vehicle ride vibration are reviewed and measured results for several vehicle types are discussed. It is shown how simple mathematical modeling can be helpful in understanding various aspects of off-road vehicle ride problems.

85-2049

Vibration and Dynamics of Off Road Vehicles

I.A. Craighead, P.R. Brown

School of Power Engrg., Newcastle upon Tyne Polytechnic

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 65-76, 8 figs, 7 tables, 10 refs

KEY WORDS: Off-road vehicles, Vibration control

The dynamics of several off road vehicles have been investigated using IBM's continuous systems modeling package with a view to improving the vehicles performance. The modeling of the vehicle components incorporated many of the nonlinearities present in vehicle suspensions such as friction and hydroelastic suspension characteristics.

85-2050

Properties of Non-Linear Two-Force Elements Used in Vehicle Dynamic Systems under Stationary Stochastic Excitation. Part 1 — Ideal Elements

M. Apetaur

Prague Univ. of Tech., Czechoslovakia

Vehicle Syst. Dynam., 13 (5), pp 215-247 (1984) 13 figs, 2 tables

KEY WORDS: Ground vehicles, Stochastic processes, Frequency domain method

Nonlinear two-force elements (springs, dampers, etc.) are commonly found in vehicle dynamic systems. Their mathematical idealization, by expressing their force-excitation relation by a real function, is called an ideal element. Excitation of these elements can be considered a stationary stochastic. Their general properties under such excitation are discussed and computation of the stochastic properties of the output force for known excitation are shown.

85-2051

Properties of Non-Linear Two-Force Elements Used in Vehicle Dynamic Systems under Stationary Stochastic Excitation. Part 2 — Realistic Complex Elements

M. Apetaur

Prague Univ. of Tech., Czechoslovakia

Vehicle Syst. Dynam., 13 (5), pp 249-279 (1984) 32 figs, 9 refs

KEY WORDS: Ground vehicles, Stochastic processes, Suspension systems (vehicles)

Realistic two-force elements used in vehicle dynamic systems often have complex output force-inputs relations. Determination of their properties under stationary stochastic excitation must be carried out experimentally for every excitational case. Evaluation of the measurements of one type of passenger car telescopic hydraulic suspension damper and one type of heavy duty truck leaf spring is shown.

85-2052

Test Device and Test Procedure to Assess Side Structures. Volume 11. Appendix 1 (Part 6)

R. Gam, S. Davis, M. Rodack, N. Johnson

Dynamic Science, Inc., Phoenix, AZ

Rept. No. R-8327-83-32/2090-VOL-11, DOT-HS-806 664, 197 pp (Aug 1983) PB85-155851/GAR

KEY WORDS: Collision research (automotive), Test equipment, Testing techniques

A deformable moving barrier (side impactors) developed to evaluate passenger vehicle side structures in front-to-side collisions, is described.

85-2053

Railway Vehicle Modelling by the Constraint Equation Method

L.M. Martin, J.G. Gimenez
Construcciones y Auxiliar de Ferrocarriles, S.A.

Vehicle Syst. Dynam., 13 (5), pp 281-297 (1984) 15 figs, 1 table, 8 refs

KEY WORDS: Railway vehicles, Rail-wheel interaction

A method for the dynamic analysis of railway vehicles is proposed. The method is based on the use of constraint equations, and on building a mathematical model by means of the initial data. The calculation models are nonlinear, due both to the connecting elements and to the wheel-rail contact modeling. Solving of differential equations is achieved by time step integration. The method has been applied to the analysis of a freight wagon and a train unit.

SHIPS

85-2054

On Ship Collisions: The Plastic Collapse of Longitudinally Framed Shell Plating Subjected to Oblique Loading

D.E. Manolakos, A.G. Mamalis
National Technical Univ. of Athens, Athens, Greece

Intl. J. Impact Engrg., 3 (1), pp 41-55 (1985), 7 figs, 2 tables, 15 refs

KEY WORDS: Collision research (ships), Plastic properties, Protective shields

Rigid plastic analysis is used for predicting the structural behavior of longitudinally framed shell plating of struck vessels during a minor oblique collision. The shell plating is divided into T-beam units. Each unit is subjected to plastic straining under the action of an oblique concentrated load, up to its penetration and fracture. Loading deflection characteristics are established resulting in the prediction of the strength of the struck vessel at any stage of deformation and for obtaining information for the design of protective structures against collisions.

AIRCRAFT

85-2055

Application of the Onera Model of Dynamic Stall

K.W. McAlister, O. Lambert, D. Petot
NASA Ames Res. Ctr., Moffett Field, CA

Rept. No. A-9824, NASA-TP-2399, 65 pp (Nov 1984), N85-12862/7/GAR

KEY WORDS: Airfoils, Stalling, Prediction techniques

A semiempirical model to predict the unsteady loads on an airfoil that is experiencing dynamic stall, is investigated. The mathematical model is described from an engineering point of view, demonstrates the procedure for obtaining various empirical parameters, and compares the loads predicted by the model with those obtained in the experiment. It is found that the procedure is straightforward, and the final calculations are in qualitative agreement with the experimental results.

85-2056

F-8 Refueling Boom Ground Vibration Test

M.W. Kahoe
NASA Ames Res. Ctr., Moffett Field, CA

Rept. No. H-1194, NASA-TM-84914, 50 pp (Jan 1985), N85-15713/9/GAR

KEY WORDS: Aircraft equipment response, Booms (equipment), Vibration tests, Natural frequencies, Mode shapes

A ground vibration test was conducted on a simulated refueling boom mounted on an F-8 airplane. The test was conducted to determine if the refueling boom modal frequencies were close to the airplane frequencies. The data presented include modal frequencies, mode shape data, and structural damping coefficients.

85-2057
Flutter Parametric Studies of Cantilevered Twin-Engine-Transport Type Wing With and Without Winglet. Volume 1: Low-Speed Investigations
K.G. Bhatia, K.S. Nagaraja
Boeing Commercial Airplane Co., Seattle, WA
Rept. No. NASA-CR-172410-V-1, 95 pp (Sept 1984), N85-13269/4/GAR

KEY WORDS: Aircraft wings, Flutter, Cantilever blades

Flutter characteristics of a cantilevered high aspect ratio wing with winglet were investigated. The configuration represented a current technology, twin-engine airplane. A low-speed and high-speed model were used to evaluate compressibility effects through transonic Mach numbers and a wide range of mass-density ratios. Four flutter mechanisms were obtained in test, as well as analysis from various combinations of configuration parameters.

85-2058
Flutter Parametric Studies of Cantilevered Twin-Engine Transport Type Wing With and Without Winglet. Volume 2: Transonic and Density Effect Investigations
K.G. Bhatia, K.S. Nagaraja
Boeing Commercial Airplane Co., Seattle, WA
Rept. No. NASA-CR-172410-V-2, 144 pp (Sept 1984), N85-13270/2/GAR

KEY WORDS: Aircraft wings, Flutter, Cantilever blades

Flutter characteristics of a cantilevered high aspect ratio wing with winglet were investigated. The configuration represented a current technology, twin engine airplane. Compressibility effects through transonic Mach numbers and a wide range of mass-density ratios were evaluated on a low speed and high speed model. Four flutter mechanisms were obtained from test, and analysis from various combinations of configuration parameters.

85-2059
Improving the Fatigue Life of the Mirage IIIO Wing Main Spar
J.Y. Mann, A.S. Machin, W.F. Lupson
Aeronautical Res. Labs., Melbourne, Australia
Rept. No. ARL-STRUC-R-398, 72 pp (Jan 1984), AD-A149 054/9/GAR

KEY WORDS: Aircraft wings, Fatigue life

An increased life-of-type requirement for Mirage IIIO aircraft operated by the RAAF was associated with a specific need to develop a refurbishment technique for extending the lives of fatigue-cracked wing main spars. This led to a comprehensive series of flight-by-flight fatigue tests on specimens of a geometry and thickness (32 mm) closely representing the inboard lower rear flange section of the spar. Of the various options investigated, the most promising was the use of interference-fit steel bushes in bolt holes-either alone or in combination with a modified anchor-nut sub-assembly which eliminated the need for some rivets in the spar flange.

85-2060
Study to Eliminate Ground Resonance Using Active Controls
F.K. Straub
Hughes Helicopters, Inc., Culver City, CA
Rept. No. NASA-CR-166609, 123 pp (Oct 1984), N85-15715/4/GAR

KEY WORDS: Helicopters, Rotors, Propeller blades, Active vibration control

The effectiveness of active control blade feathering in increasing rotor body damping and the possibility to eliminate ground resonance instabilities were investigated. An analytical model representing rotor flapping and lead-lag degrees of freedom and body pitch, roll, longitudinal and lateral motion was developed. Active control blade feathering was implemented as state variable feedback through a conventional swashplate. The influence of various feedback states, feedback gain, and weighting between the cyclic controls was studied through stability and response analyses.

BIOLOGICAL SYSTEMS

HUMAN

85-2061

Assessment of Random Vertical Vibration on Human Body Fatigue Using a Physiological Approach

M. Demić
Zavodi 'Crvena Zastava,' 'Zastava Razvoj,' Kragujevac, Yugoslavia

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 91-95, 8 figs, 17 refs

KEY WORDS: Human response, Random vibration

To create optimal oscillatory parameters in means of transport it is necessary to consider the reaction of the body to stochastic vibration. This problem is analyzed here from the physiological point of view. The research is based on recordings of the vertical, lateral and longitudinal accelerations of the head during normal walking and on the analysis of their frequencies.

85-2062

The Origins and Characteristics of Motor Cycle Noise

P.E. Waters
Vehicle Standards and Engrg. Div., Dept. of Transport, London SW2, UK

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 207-216, 8 figs, 1 table, 29 refs

KEY WORDS: Motorcycles, Noise generation, Human response

Test data for a number of motorcycles are presented showing the effects of both engine speed and road speed on noise. The origins of motorcycle noise are discussed and it is shown how the characteristics of the individual sources combine to produce the overall noise characteristics of the machine. A new theory, equally applicable to motorcycles and other classes of vehicle, to account for the tire noise to speed relationship is presented.

85-2063

Occupational Noise Exposure on Construction Sites

W.A. Utley, L.A. Miller
Building Res. Station, Garston, Watford WD2 7JR, UK

Appl. Acoust., 18 (4), pp 293-303 (1985) 2 figs, 1 table, 3 refs

KEY WORDS: Construction equipment, Noise generation, Human response

An exploratory study of the noise exposure of operators of plant and equipment on construction sites is described. Noise at the ears of operators has been measured in terms of maximum sound pressure levels and short-term values of the equivalent continuous A-weighted sound pressure level.

MECHANICAL COMPONENTS

ABSORBERS AND ISOLATORS

85-2064

The Effect of Sequential Damping on Ride Comfort Improvement

T. Sireteanu
Institute for Physics and Technology of Materials, Bucharest, Rumania

Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 77-82, 8 figs, 1 table, 4 refs

KEY WORDS: Shock absorbers, Ground vehicles, Dynamic vibration absorption (equipment)

A mathematical model for sequential damping as well as a practical way to realize it is presented. The suspensions equipped by sequential shock absorbers are shown to be

superior to conventional systems in ride comfort but less effective in road-holding. If dynamic absorbers are used for control of axle vibrations it is shown that similar road-holding can be achieved.

85-2065

The Dynamic Response of Vehicles with Hydro-Gas Suspension to Roadway Undulation

Chu Yiqing, Li Zhongyuan

Acta Armamentarii (2), pp 30-42 (1984)
CSTA No. 623.4-84.11

KEY WORDS: Suspension systems (vehicles), Road-vehicle interaction

The body of a vehicle with a hydro-gas spring is considered as a nonlinear system having both square and cubic terms with two degrees of freedom. By means of the perturbation theory, the periodic solution and the relation between excitation and response of the system under the action of harmonic excitation are obtained. New phenomena and characteristics of this system, such as indefinition of hardening or softening spring, deviation, coupling and beat, are discussed.

85-2066

An Open Tube Technique for the Measurement of Acoustic Parameters of Porous Absorbing Materials

J.I. Dunlop
Univ. of New South Wales, P.O. Box 1, Kensington, Australia 2033

J. Acoust. Soc. Amer., 77 (6), pp 2173-2178 (June 1985) 7 figs, 2 tables, 6 refs

KEY WORDS: Acoustic absorption, Porous materials, Acoustic properties, Measurement techniques, Acoustic impedance

A new method of measuring the acoustic parameters of porous materials is described. The method is based on the measurement of radiation impedance at the end of an open flanged pipe placed against a sample. Five samples of polystyrene foam of differing porosities were used to assess the usefulness of the method.

85-2067

Vibration Isolation for Laser Light Scattering from Liquid Surfaces

B. Koyuncu, J.C. Earnshaw
The Queen's Univ. of Belfast, Belfast BT7 1NN, Northern Ireland

J. Phys., E: Sci. Instrum., 18 (5), pp 396-398 (May 1985) 3 figs, 5 refs

KEY WORDS: Vibration isolation, Lasers

Light scattering studies of thermally excited capillary waves at fluid interfaces are peculiarly susceptible to disturbance by external vibration even with a vibration-isolated optical table. The simple expedient of freely suspending the sample cell above the table is shown to substantially reduce the sensitivity of the system to such perturbation.

85-2068

Forced Vibrations of a Circular Plate with a Nonlinear Dynamic Vibration Absorber

H. Kojima, K. Nagaya
Gunma Univ., 1-5-1 Tenjin-cho, Kiryu, Gunma 376

Bull. JSME, 28 (236), pp 309-314 (Feb 1985) 11 figs, 14 refs

KEY WORDS: Circular plates, Forced vibration, Dynamic vibration absorption (equipment)

Forced vibrations of a circular plate with a nonlinear dynamic vibration absorber are investigated theoretically. It is demonstrated that the optimal tuning and damping parameters for a nonlinear magnetic dynamic vibration absorber with a hardening spring can be easily found by using the simplex method.

SPRINGS

85-2069

Analysis of Static and Dynamic Stresses in Helical Spring

T. Sawanobori, Y. Akiyama, Y. Tsukahara, M. Nakamura

Yamanashi Univ., 4-3-11, Takeda, Kofu-shi-Yamanashi, Japan
Bull. JSME, 28 (238), pp 726-734 (Apr 1985) 10 figs, 10 refs

KEY WORDS: Helical springs, Finite element technique

Static and dynamic stresses in helical springs are analyzed systematically using the finite element method. In the static stress analysis, the effects of the pitch angle on stresses are investigated. It is revealed that the maximum principal stress governing the fatigue fracture of springs is larger on the outside of coils than on the inside in the case of a large pitch angle, and that the cracks may start from the outside of coils. In the dynamic stress analysis, stress distribution along the wire are evaluated in a similar way to the static stress analysis and it is indicated that dynamic stress are much larger than static stresses. The results obtained are corroborated with the experimental results.

TIRES AND WHEELS

85-2070
Lorry Tyre Noise
P.M. Nelson, M.C.P. Underwood
Transport and Road Research Laboratory, Crowthorne, Berkshire, UK
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 21-30, 8 figs, 2 tables, 23 refs

KEY WORDS: Tires, Noise generation

Noise produced by the action of lorry tires rolling on road surfaces is examined and an attempt is made to identify both the main sources and the mechanism of noise generation. A parametric study showed the rolling speed of the tire was the main factor affecting the overall levels of tire noise. Other factors of importance were wheel loads, tire tread and road surface pattern, tire construction and materials, acoustic absorption by the road surface and the presence of surface water.

85-2071
Investigations Concerning Tyre/Road Noise Sources and Possibilities of Noise Reduction
M. Jennewein, M. Bergmann
Inst. for Technical Acoustics, Technical Univ. of Berlin
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 235-245, 8 figs, 4 refs

KEY WORDS: Tires, Noise generation, Noise reduction

Numerous possible generating mechanisms for the rolling noise of tires were derived with the aid of several different measuring methods. The knowledge of these noise generating processes leads to a broad spectrum of possibilities to reduce tire noise, but each of these possibilities effects only a small amount of noise reduction.

85-2072
Fatigue Behaviour of Cast Aluminum Wheels for Commercial Vehicles (Festigkeitsverhalten von gegossenen Aluminiumrädern für Nutzfahrzeuge)
G. Fischer, V. Grubisic
Menzelweg 6, 6100 Darmstadt
Automobiltech. Z., 87 (2), pp 67-73 (Feb 1985) 11 figs, 10 refs (In German)

KEY WORDS: Wheels, Aluminum, Fatigue life

Cast aluminum wheels were examined for fatigue behavior. The fatigue strength data of individual wheel areas, being necessary for an optimum sizing of the wheel, are determined in different test rigs. The proof out tests were carried out under simulated operational loads. These tests were done in a biaxial wheel test machine where all areas of wheels were stressed as in service.

BLADES

85-2073
A General Model of Helicopter Blade Dynamics

A. Rosen, O. Rand
Israel Inst. of Technology, Haifa 32000, Israel
Vertica, 9 (1), pp 35-50 (1985) 12 figs, 14 refs

KEY WORDS: Propeller blades, Helicopters, Mathematical models

A general model which describes the helicopter blade dynamics is presented. The paper concentrates on the modeling of the blade motions, structural behavior and inertia loads and therefore a relatively simple aerodynamics is used, but as a result of the flexibility of the complete model and its modular construction, any description of the aerodynamic loads can be adopted quite easily.

BEARINGS

85-2074
The Experimental Evaluation of Fluid Film Bearings
P.G. Morton
Stafford Mechanical Laboratory, GEC E.R.C., Stafford, England
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 147-158, 10 figs, 1 table, 34 refs

KEY WORDS: Fluid-film bearings, Stiffness coefficients, Damping coefficients

The role played in rotordynamics by fluid film bearings, with particular reference to influence on critical speeds, response to unbalance and system instability is described. The main part of the paper is devoted to a description of modern experimental techniques for finding the characteristics of large, oil lubricated bearings. The techniques involve rig work as well as in situ measurements, on machines embodying such bearings.

85-2075
Experimental Determination of the Stiffness and Damping Coefficients of Fluid Film Bearings by Means of Step Forces
Chang Cheng-Song, Zheng Pei-Yi
Tsinghua Univ., Beijing, People's Rep. China
Trib. Intl., 18 (2), pp 81-91 (Apr 1985) 18 figs, 1 table, 4 refs

KEY WORDS: Fluid-film bearings, Stiffness coefficients, Damping coefficients, Spectrum analysis

A method of identifying bearing dynamic coefficients by means of step forces is described. Obtaining an accurate fast Fourier transform of the rapidly varying step function is difficult since the limitations of real time analysis by minicomputer make truncation necessary. This paper therefore proposes a feasible approach to direct analysis of the spectrum of the step function and introduces its application to measure the stiffness and damping coefficients of journal bearings.

85-2076
Field Analysis of Bearing Instability Caused by Foundation Settlement
Z. Racic
Utility Power Corp., Bradenton, FL
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 37-43, 20 figs, 8 refs

KEY WORDS: Bearings, Turbomachinery, Foundations, Alignment, Case histories

A case history of the Turboset experiencing bearing instability from the first roll through several months of operation is presented and events from the analysis of plant permanent supervisory records are followed through test data evaluation and problem recognition.

GEARS

85-2077
Changing of Power Transmitting Characteristics of Cylindrical Involute Gears Owing to Scoring Failure

A. Kubo
Kyoto Univ., Kyoto 606 Japan
Bull. JSME, 28 (236), pp 342-349 (Feb 1985) 12 figs, 3 tables, 11 refs

KEY WORDS: Gears, Failure analysis

Scoring failure occurring on involute spur or helical gears, causing their power transmitting characteristics to become different from those before scoring initiation, is investigated. Measured and analyzed states of tooth fillet stress show that it increases considerably with progress of scoring.

85-2078

A Torsional Study of a Cooling Tower Fan Drive System

J.G. Winterton
Philadelphia Gear Corp., King of Prussia, PA
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 115-119, 6 figs, 2 tables, 4 refs

KEY WORDS: Gears, Torsional vibration, Fans, Cooling towers

A recent field study conducted to establish the probable cause of failure of geardrives employed by the cooling tower industry is discussed. The paper centers about torsional related phenomena and their investigation using virtually all the available techniques for field study of torsional vibration. The importance of the analytical study to optimize transducer placement is emphasized.

85-2079

Failure Analysis and Wear Mechanism Study of a Heavily Loaded Gear

Wang Fuxing, Cai Qigong, Zhang Yongxin
Tsinghau Univ., Beijing, People's Rep. China
Trib. Intl., 18 (2), pp 93-99 (Apr 1985) 11 figs, 1 table, 6 refs

KEY WORDS: Gears, Wear, Failure analysis

Failure analysis and a study of the wear mechanism were performed on a heavily loaded carburized gear with some unusual features. The analysis showed that the different failure forms on the tooth surface of the gear were dependent on the sub-surface shearing stress, the lubrication conditions and the surface roughness.

85-2080

Simple Operating Mode Shapes or Displacements for a Printing Press Gearbox and Main Gears

J.C. Morehead, III
Miller Printing Equipment Corp.
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 71-80, 5 figs, 3 refs

KEY WORDS: Gear boxes, Gears, Mode shapes, Presses, Printing

A sheet-fed press gearbox, replaced in a plant when registration (print location precision) was inadequate, is described. In order to study the effects of the bad gearbox on press vibrations it was installed in a TP-41A press, vibration measurements were made, and the data were compared with data taken when a good gearbox was used.

85-2081

Vibration of Power Transmission Helical Gears (The Effect of Contact Ratio on the Vibration)

K. Umezawa, T. Suzuki, H. Houjoh, T. Sato
Tokyo Inst. of Technology, Nagatsuta, Midori-ku, Yokohama, 227, Japan
Bull. JSME, 28 (238), pp 694-700 (Apr 1985) 13 figs, 2 tables, 21 refs

KEY WORDS: Helical gears, Vibration control, Noise reduction

On a pair of power transmission helical gears with a comparatively narrow facewidth, the relation between contact ratio and vibration is investigated experimentally for the purpose of decreasing vibration and noise.

85-2082
Study on Stresses at the Root Fillet of Tooth, Deformation and Accuracy Deterioration of Spur Gear with a Thin Rim When Rate of Load Distribution under Dynamic Condition is Considered
N. Arai, S. Harada, N. Mori, M. Okamoto
Doshisha Univ., Karasuma Imadegawa, Kamikyoku, Kyoto, Japan
Bull. JSME, 28 (236), pp 350-358 (Feb 1985) 20 figs, 4 refs

KEY WORDS: Spur gears

By using rate of load distribution of tooth and the same loaded condition as that in the dynamic condition, stresses and deformations of teeth and rim of spur gears with a thin rim were calculated, and the calculated results (by the finite element method) were compared with the experimental ones. Accuracy deterioration of spur gears with a thin rim was discussed.

85-2083
Study on the Effect of Tooth Fatigue on Dynamic Performance of Gear Pair (2nd Report: In the Case of Case-hardened Chromium Molybdenum Steel Gears)
A. Yoshida, K. Fujita, T. Kanehara, K. Kominami
Okayama Univ., Tsushima, Okayama City, 700 Japan
Bull. JSME, 28 (236), pp 322-328 (Feb 1985) 13 figs, 3 refs

KEY WORDS: Gear teeth, Fatigue tests

For elucidating the effect of tooth fatigue on dynamic performance of case-hardened gears, the gears were fatigue-tested by a power circulating gear testing machine, and tooth root strain, vibration acceleration level and sound pressure level were measured. The tooth failure mode was classified into two types: a tooth breakage by bending fatigue at the tooth fillet, and a tooth breakage due to surface fatigue near the pitch point.

FASTENERS

85-2084
Influence of Fastener Flexibility on Load Transfer and Fatigue Life Predictions for Multirow Bolted and Riveted Joints
H. Huth
Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Darmstadt, Fed. Rep. Germany
Rept. No. LBF-FB-172/84, 147 pp (1984)
N85-16219/6/GAR (In German)

KEY WORDS: Bolted joints, Fatigue life

A universal formula to calculate fastener flexibility was derived from load deformation measurements performed with a variety of commonly used types of single and double shear joints under quasi-static and flight-by-flight loading conditions. The improved accuracy of load transfer calculations is proved by comparative load transfer measurements with multirow joints.

SEALS

85-2085
Mechanical Face Seal Dynamics Update
I. Etsion
Technion - Israel Inst. of Technology, Haifa 32000, Israel
Shock Vib. Dig., 17 (4), pp 11-15 (Apr 1985) 26 refs

KEY WORDS: Seals, Reviews

This review is an update of literature published since 1981 on mechanical face seal dynamics. Experimental observations as well as theoretical analyses are summarized. Future research needs in mechanical face seal dynamics are pointed out.

STRUCTURAL COMPONENTS

STRINGS AND ROPES

85-2086
Stochastic Finite Element Analysis of a Vibrating String

F.S. Wong
Weidlinger Associates, Palo Alto, CA 94304-1014
J. Sound Vib., 96 (4), pp 447-459 (Oct 22, 1984) 5 figs, 5 refs

KEY WORDS: Strings, Finite element technique, Stochastic processes

The response of a vibrating string subjected to spatial white noise excitation is analyzed by using the finite element (Galerkin) method. The discretization is achieved by using basis functions in the spatial and random spaces. The continuous time finite element equations are then integrated in time by using the central difference algorithm.

BARS AND RODS

85-2087
On the Dynamics of Elastic-Plastic Buckling (Zur Dynamik des elastisch-plastischen Knickens)
P. Vielsack
Institut f. Mechanik, Universitat Karlsruhe, Postfach 6380, D-7500 Karlsruhe 1, Bundesrepublik Deutschland
Ing. Arch., 54 (4), pp 268-274 (1984), 3 figs, 8 refs (In German)

KEY WORDS: Rods, Elastic-plastic properties, Dynamic buckling

A rheological model with dry friction properties and hysteresis is used to investigate the dynamics of a compressed rod of elastic-plastic material. Stationary points and their stability are discussed in phase-planes as functions of the load history.

BEAMS

85-2088
On the Acoustic Power Radiated by Line Forces on Elastic Beams
R.F. Keltie, H. Peng
North Carolina State Univ., Raleigh, NC 27695-7910
J. Acoust. Soc. Amer., 77 (6), pp 2033-2038 (June 1985), 10 figs, 10 refs

KEY WORDS: Beams, Sound waves, Wave radiation, Line source excitation

The importance of the spatial extent of applied forces in the topic of structural radiation is studied through formulation of the sound power radiated by a line force acting on an infinite elastic beam. Results are discussed in terms of the coupled structural/acoustic wavenumber response function and the wavenumber spectrum of the applied force. In addition the relative effects of light fluid loading on the radiation at coincidence are presented.

85-2089
A Note on the Vibrations of Restrained Beams and Rods with Point Masses
M. Gurgoze
Technical Univ. of Istanbul, Istanbul, Turkey
J. Sound Vib., 96 (4), pp 461-468 (Oct 22, 1984), 5 figs, 2 tables, 13 refs

KEY WORDS: Beams, Rods, Fundamental frequencies, Fundamental modes, Point masses

The approximate determination of the fundamental frequency and first mode shape of a beam or rod to which springs and point masses are attached is analyzed. After formulating the general eigenvalue problem which forms the basis of the analysis, the theory is applied to three examples.

85-2090
Vibration Response of Geometrically Nonlinear Elastic Beams Subjected to Pulse and Impact Loading
E.T. Moyer, Jr.
The George Washington Univ., Washington, D.C. 20052
Computers Struc., 20 (4), pp 721-729 (1985), 9 figs, 7 refs

KEY WORDS: Beams, Pulse excitation, Impact excitation, Flexural vibrations

The governing equations for the geometrically nonlinear deformation of elastic beams subjected to dynamic bending loads are developed and solved for various initial conditions. Of primary interest is the response to pulse loading and simulated impact. Both transient and several cycle solutions are generated for the free vibration response to pulse loading. The results obtained are compared to a first mode analysis approximation.

85-2091
Plastic Response to Impact of a Simply Supported Beam with a Stable Crack
S. Kumar, H.J. Petroski
Duke Univ., Durham, NC 27706
Intl. J. Impact Engrg., 3 (1), pp 27-40 (1985), 10 figs, 1 table, 12 refs

KEY WORDS: Beams, Cracked media, Impact response, Plastic properties,

A rigid perfectly plastic model is developed to study the effects of a central crack on the plastic response of a beam subjected to a central transverse impact load. The governing differential equations are expressed in terms of non-dimensional parameters representing the crack size, beam to projectile mass ratio, and energy input. The equations are solved numerically to obtain general solutions and the effects of the parameters on the final permanent deformation are isolated and studied to identify the relative significance of each parameter.

COLUMNS

85-2092
Reliability of Elastic Structures Driven by Random Loads
A. Katz, Z. Schuss
Tel-Aviv Univ., Ramat-Aviv, Israel
SIAM J. Appl. Math., 45 (3), pp 383-402 (June 1985), 2 figs, 16 refs

KEY WORDS: Columns, Random excitation, Reliability

The stability of an elastic column driven by a fluctuating load is studied. A sequence of approximations to the continuous column by a simple pendulum with an impulsive random force applied at the hinge, a double pendulum, and an N-fold pendulum with a vertical or tangential random load, is considered.

PANELS

85-2093
Flutter Analysis of Thin Cracked Panels Using the Finite Element Method
Wen-Hwa Chen, Heng-Chih Lin
National Tsing Hua Univ., Hsinchu, Taiwan, China
AIAA J., 23 (5), pp 795-801 (May 1985), 8 figs, 24 refs

KEY WORDS: Panels, Cracked media, Flutter, Finite element technique

An assumed hybrid-displacement finite element model is presented to deal with the flutter problems of thin cracked panels. Based on a modified Hamilton's principle for nonconservative systems with relaxed continuity requirements for deflections and normal slopes at the interelement boundary, the aerodynamic properties of rectangular-shaped hybrid crack elements around the crack tip embedded with proper stress singularities are derived. Interelement compatibility conditions are satisfied through the use a langrangian multiplier technique and the assumption of interelement boundary deflections.

85-2094
Calculation of Sound Insulation of Ribbed Panels Using Statistical Energy Analysis
A. Elmallawany
Building Res. Centre, P.O. Box 1770, Cairo, Egypt
Appl. Acoust., 18 (4), pp 271-281 (1985), 7 figs, 9 refs

KEY WORDS: Panels, Acoustic insulation, Statistical energy methods, Ship noise

The method of statistical energy analysis has been used to calculate the sound insulation of single and double partitions. The application of this method to calculate the sound insulation of ribbed panels is discussed. The results of experiments conducted to test the theory are reported. Agreement between theory and experiment is shown to be satisfactory.

PLATES

85-2095

The Inverse Source Problem for an Oblique Force on an Elastic Plate

J.E. Michaels, Yih-Hsing Pao
Cornell Univ., Ithaca, NY 14853

J. Acoust. Soc. Amer., 77 (6), pp 2005-2011 (June 1985), 7 figs, 2 tables, 19 refs

KEY WORDS: Plates, Transient response, Force coefficients

A time-dependent concentrated force applied obliquely on the surface of a plate generates elastic waves in the plate. The determination of the location, orientation, and time history of the force from the transient wave records is referred to as the inverse source problem of elastic waves. This paper presents an iterative method of deconvolution which determines the orientation and time-dependent amplitude of the force from the transient response of the plate surface at a minimum of two locations, the source location being given. Numerical results are presented for forces with various orientations and time histories, and for synthetic data both with and without noise.

85-2096

Fundamental Frequency of Vibrating Rectangular, Non-homogeneous Plates

R.H. Gutierrez, P.A.A. Laura
Inst. of Appl. Mechanics, Puerto Belgrano Naval Base 8111, Argentina

Appl. Acoust., 18 (3), pp 171-180 (1985), 3 figs, 6 tables, 4 refs

KEY WORDS: Rectangular plates, Fundamental frequency, Ritz method

An approximate solution is obtained using the classical Ritz method. The use of polynomial coordinate functions allows for the treatment of edges elastically restrained against rotation.

85-2097

A Review of the Literature on Finite-Element Modeling of Laminated Composite Plates

J.N. Reddy
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA 24061

Shock Vib. Dig., 17 (4), pp 3-8 (Apr 1985), 51 refs

KEY WORDS: Plates, Composite structures, Reviews

This review of the literature on the finite-element modeling of natural vibrations of plates is confined to the period from 1980 to the present. A historical background of the development of shear deformation theories is also presented.

85-2098

Nonlinear Vibrations of an Elastic Disk Rotating in a Viscous Fluid

J.L. Nowinski
Univ. of Delaware, Newark, DE 19711

Ing. Arch., 54 (4), pp 291-300 (1984), 2 figs, 30 refs

KEY WORDS: Disks, Fluid-induced excitation, Viscosity effects

The von Karman equations are extended to the dynamic case and to manifest the effects of the viscosity of fluid in which the motion takes place. The hydrodynamic aspect of the problem is analyzed and the flow pattern based on the von Karman solution derived. The system of two nonlinear coupled differential equations is solved for weakened boundary conditions using the Galerkin procedure.

85-2099
Nonlinear Axisymmetric Vibration of Orthotropic Thin Annular Plates with a Rigid Central Mass
P.C. Dumir, Ch.R. Kumar, M.L. Gandhi
Indian Inst. of Technology, New Delhi 110016, India
J. Acoust. Soc. Amer., 77 (6), pp 2184-2187 (June 1985), 3 figs, 2 tables, 10 refs

KEY WORDS: Annular plates, Axisymmetric vibrations, Orthotropism

Large amplitude asixymmetric vibrations of uniform and tapered orthotropic annular plates with a rigid central mass are studied. A time-mode solution of the von Karman-type-governing equations is obtained using the Kantorovich averaging method. The orthogonal point collocation method is used for spatial discretization. The effect of various parameters is studied.

85-2100
Sound Absorption Properties of a Perforated Plate and Membrane Construction
A.C. Nilsson, B. Rasmussen
Danish Acoustical Inst., Technical Univ., DK-2800 Lyngby, Denmark
Acustica, 57 (3), pp 139-148 (March 1985), 15 figs, 3 refs

KEY WORDS: Acoustic absorption, Plates, Membranes

A prediction model describing the absorption coefficient of a plate and membrane system is derived. Measurements of absorption coefficients in an impedance tube and in a reverberation chamber are carried out for various constructions. Predicted and measured results are compared.

SHELLS

85-2101
Resonance Response of Submerged, Acoustically Excited Thick and Thin Shells
G.C. Gaunaurd, M.F. Werby
Naval Surface Weapons Ctr., Silver Spring, MD 20910
J. Acoust. Soc. Amer., 77 (6), pp 2081-2093 (June 1985), 16 figs, 40 refs

KEY WORDS: Shells, Submerged structures, Resonant response

The elastodynamic spectral response of thick and thin shells in water, undergoing resonance scattering caused by the incidence of sound waves that impinge upon them at selected aspects, is studied. All the shells considered are elastic, air filled, and of cylindrical and prolate spheroidal shapes. Their thickness is intentionally varied three orders of magnitude from very thick to very thin so that the effects of shell stiffness on their scattering behavior can be quantitatively analyzed and understood.

85-2102
On the Cracked Bell
H.J. Petroski
Duke Univ., Durham, NC 27706
J. Sound Vib., 96 (4), pp 485-493 (Oct 22, 1984), 3 figs, 1 table, 16 refs

KEY WORDS: Shells, Cracked media, Bells

A simple model based on energy methods of applied mechanics is developed and employed to study the effect of clapper location on the initiation and growth of cracks in bells. The origins of cracks in the Liberty Bell and Big Ben are discussed, and the simple model is employed to explain why remedial measures on Big Ben, though perhaps not optimal, have prolonged its life.

85-2103
The Approximate Determination of the Stress Intensity Factor of a Very Short Radial Crack on the Internal Surface of a Thick-Walled Cylinder Exposed to Compressive Loading of Both Surfaces
F. Kuba
Technical Univ. of Mines, Ostrava-Poruba, Czechoslovakia

Strojnícky Časopis, 35 (6), pp 721-737 (1984), 7 figs, 3 tables, 6 refs (In Czech)

KEY WORDS: Cylindrical shells, Cracked media, Stress intensity factors

A simple solving-procedure is described for approximate determination of stress intensity factors for thick-walled cylinders having very short cracks on the internal surface of the body in the radial direction. The method is easily applicable and for cases of early stages of crack extension is accurate.

85-2104
Finite Element Analysis of Nonlinear Oscillations and Flutter of Shells of Revolution
A. Maewal
Yale Univ., New Haven, CT
Rept. No. AFOSR-TR-84-1126, 58 pp (Apr 6, 1984), AD-A149 071/3/GAR

KEY WORDS: Shells of revolution, Flutter, Finite element technique

A finite element methodology is described for analysis of steady nonlinear periodic oscillations of axisymmetric shells. The technique is a combination of asymptotic analysis and the finite element method and results it yields include the significant effect of nonlinear interaction between the waves that travel in opposite directions along the circumference. An extended numerical method is described which is applicable to shells rotating at a constant speed about their geometrical axes A general solution for the problem of nonlinear flutter of axisymmetric shells is also presented.

RINGS

85-2105
The Vibration of Rings of Unsymmetrical Cross-Section
J. Kirkhope, R. Bell, J.L.D. Olmstead
Carleton Univ., Ottawa, Canada K1S 5B6
J. Sound Vib., 96 (4), pp 495-504 (Oct 22, 1984), 3 figs, 7 tables, 5 refs

KEY WORDS: Rings, Natural frequencies

The vibration of complete uniform rings of unsymmetrical solid section is studied experimentally and numerically. Models for thick and thin rings are described and assessed with respect to accuracy. It is shown that a ring model having six degrees of freedom can predict frequencies accurately for modes of up to six nodal diameters of thick rings of arbitrary unsymmetrical cross-section.

PIPES AND TUBES

85-2106
Acoustic Design of Variably Segmented Pipes
Y.C. Chiang, A.A. Seireg
Univ. of Wisconsin, Madison, WI
Computers Mech. Engrg., 3 (6), pp 57-59 (May 1985), 4 figs, 2 tables, 5 refs

KEY WORDS: Pipes, Musical instruments, Sound generation

computer simulation and optimization is used to design a pipe that generates sound from air flow. A pipe geometry is derived that produces the sound spectrum of an ideal violin.

85-2107
Organ-Pipe Oscillation
W. Jzy
Imperial College of Science and Technology, London, England
Rept. No. PDR/CFDU-IC/14, 29 pp (Feb 1984), N85-13199/3/GAR

KEY WORDS: Pipes, Organs (musical instruments), Oscillations, Computer programs

The ability of the PHOENICS program to calculate an organ pipe oscillation was tested. Quantitative PHOENICS results agree with those of an analytical solution.

DUCTS

85-2108
Measuring the Acoustic Properties of Ducts
T.E. Vigran
The Norwegian Inst. of Technology, The Univ. of Trondheim, N-7034 Trondheim-NTH, Norway
Appl. Acoust., 18 (4), pp 241-249 (1985), 5 figs, 7 refs

KEY WORDS: Ducts, Acoustic properties, Measurement technique, Two microphone techniques

A short review, with examples, is given of a two-microphone transfer function method intended for making measurements in a tube or duct system. The method has proved useful in measuring the absorption coefficient, impedance and transmission loss, when dealing with plane wave propagation; i.e., for frequencies below the duct cut-off frequency.

85-2109
Transonic Shock-Wave/Turbulent Boundary-Layer Interactions in a Circular Duct
D. Om, J.R. Viegas, M.E. Childs
Univ. of Washington, Seattle, WA
AIAA J., 23 (5), pp 707-714 (May 1985), 10 figs, 2 tables, 27 refs

KEY WORDS: Shock wave-boundary layer interaction, Ducts

Detailed pitot, static, and wall pressure measurements have been obtained for a transonic normal shock-wave/turbulent boundary-layer interaction. Comparisons are made with solutions to the time-dependent, mass-averaged, Navier-Stokes equations incorporating a two-equation, Wilcox-Rubesin turbulence model. The computations are in agreement with the experimental results.

BUILDING COMPONENTS

85-2110
Structures to Resist the Effects of Accidental Explosions. Volume 3. Principles of Dynamic Analysis
M. Dede, F. Sock, S. Lipvin-Schramm, N. Dobbs
Ammann and Whitney, New York, NY
Rept. No. ARLCD-SP-84001-VOL-3, SBI-AD-E401 178, 413 pp (June 1984), AD-A148 895/6/GAR

KEY WORDS: Structural members, Blast response

Procedures for analyzing structural elements subject to blast overpressures are presented. The basic principles of dynamics as well as procedures for calculating the various components used to perform the analyses are discussed. Resistance-deflection functions for various elements including both one-and two-way panels as well as beam elements are also presented.

DYNAMIC ENVIRONMENT

ACOUSTIC EXCITATION

85-2111
Noise-Related Shear-Layer Dynamics in Annular Jets
R.W. Wlezien, V. Kibens
McDonnell Douglas Corp., St. Louis, MO
AIAA J., 23 (5), pp 715-722 (May 1985), 10 figs, 11 refs

KEY WORDS: Noise reduction, Jet noise

Suppression of low-frequency noise is observed for subsonic annular jets with extended centerbodies. The dynamics of annular jets both with and without centerbody extensions are investigated experimentally to determine the noise-reduction mechanism. Detailed spectral contour maps are used to illustrate the spatial development of the velocity spectrum, and the limitations of single-point measurements are discussed.

85-2112
A Study on Mufflers with Air Flow (2nd Report: Various Methods for the Reduction of Air Flow Noise)
H. Izumi, N. Kojima, M. Fukuda
Yamaguchi Univ., Tokiwadai, Ube, Japan
Bull. JSME, 28 (238), pp 631-637 (Apr 1985), 24 figs, 6 refs

KEY WORDS: Mufflers, Noise reduction

Experimental studies on methods for reducing air flow noise which is generated in expansion cavity type mufflers are presented. In this paper, the effects of various methods for reduction of impact energy and air flow noise are systematically studied.

85-2113
Application of the Least-Squares Method to Sound-Source Separation in a Multi-Source Environment
M. Yanagida, Y. Miyoshi, Y. Nomura, O. Kakusho
Osaka Univ., Osaka 567, Japan
Acustica, 57 (3), pp 158-167 (March 1985), 13 figs, 1 table, 15 refs

KEY WORDS: Sound waves, Wave propagation, Least squares method

The least-squares method is applied to sound-source separation. A concept of matrix convolution is introduced as an expression of multi-channel convolution, and a generalized convolutional inverse matrix is employed to formulate the least-squares multi-channel deconvolution in the time domain contrasting with that in the frequency domain. Two approaches are presented for describing the transfer characteristics of the sound propagation paths.

85-2114
Nonlinear Sound Waves from a Uniformly Moving Point Source
B.O. Enflo
Royal Inst. of Technology, Stockholm, Sweden
J. Acoust. Soc. Amer., 77 (6), pp 2054-2060 (June 1985), 8 refs

KEY WORDS: Sound waves, Wave propagation, Point source excitation

Nonlinear sound waves from a uniformly moving source with dimensions smaller than the wavelength of the emitted sound are investigated. They are described by spherical Burgers' equations.

85-2115
A Shallow Water Experiment to Determine the Source Spectrum Level of Wind-Generated Noise
W.A. Kuperman, M.C. Ferla
SACLANT ASW Res. Centre, 19026 La Spezia, Italy
J. Acoust. Soc. Amer., 77 (6), pp 2067-2073 (June 1985), 8 figs, 1 table, 22 refs

KEY WORDS: Water, Wind induced excitation, Noise generation

An experiment was conducted in a shallow water region of the Mediterranean Sea to study wind-generated noise. In addition to measuring the noise field, propagation-loss data were collected and used in a detailed modeling of the environment. The environmental information was then used as input to a noise model based on wave theory that computes the noise field in the water column for a given (unknown) source strength. By comparing model predictions with data, the influence of the environment on recorded noise levels could be removed and a measure of the noise source spectrum levels obtained as a function of wind speed.

85-2116
An Assessment of Second-Order Perturbation Theory for Scattering of Sound by Hard, Statistically Rough Surfaces
A. Tolstoy, D. Berman, O. Diachok
Naval Res. Lab., Washington, DC 20375
J. Acoust. Soc. Amer., 77 (6), pp 2074-2080 (June 1985), 7 figs, 12 refs

KEY WORDS: Sound waves, Wave scattering, Perturbation theory

Perturbation theory and boss models for rough surface scattering are compared for

the case of a surface bossed with oblate hemispheroids is compared. The surface consists of identical, hard, hemispheroidal bosses sparsely and independently distributed on a hard plane by means of a uniform probability law. To apply perturbation tł y the surface correlation function is computed, operated on that function, and an effective boundary admittance is computed. That admittance is compared with (farfield) near-exact results for hemispherical bosses and for oblate hemispheroidal bosses.

85-2117

Sound Transmission Loss: Comparison of Conventional Techniques with Sound Intensity Techniques

R.E. Halliwell, A.C.C. Warnock
National Res. Council of Canada, Ottawa, Ontario, Canada K1A 0R6
J. Acoust. Soc. Amer., 77 (6), pp 2094-2103 (June 1985), 13 figs, 27 refs

KEY WORDS: Sound transmission loss, Acoustic intensity method

Sound transmission losses for a single layer wall are measured in a reverberation room facility using conventional methods (ASTM E90) and the more recently introduced sound intensity method. The specimen is placed in five positions in the tunnel between the two reverberation rooms and measurements are made for four different absorptive conditions in the smaller room. Significant differences between the two measurement techniques are found at low frequencies and at high frequencies.

85-2118

Sound Radiation from a Housing Having a Latticed Rib

K. Umezawa, M. Sugiyama, H. Houjoh
Tokyo Inst. of Technology, Nagatsuta-cho, Yokohama 227, Japan
Bull. JSME, 28 (238), pp 687-693 (Apr 1985), 12 figs, 1 table, 3 refs

KEY WORDS: Sound waves, Wave radiation

Using a latticed rib as a sound reflector, its effect on sound radiation from a housing is discussed. A module of the reflector, a box with a baffle, surrounding four rectangular reflector plates and an aperture, proposes a new formulation in terms of mirror images.

85-2119

Solution of the Fundamental Problem of Transient Acoustic Propagation in a Borehole with the Hybrid Method

Leung Tsang
Univ. of Washington, Seattle, WA 98195
J. Acoust. Soc. Amer., 77 (6), pp 2024-2032 (June 1985), 9 figs, 1 table, 19 refs

KEY WORDS: Sound waves, Wave propagation

The fundamental acoustic logging problem of a pulsed point source surrounded by both vertical and horizontal boundaries is solved with the hybrid method. The hybrid method yields the complete synthetic waveform including the head wave and the normal mode arrivals. The essence of the hybrid method consists in converting the head wave branch-cut contribution into discrete modes which, together with the normal modes, form a complete basis for the solution in each region.

85-2120

Elastic Wave Scattering from Cavities and Sound Inclusions Analyzed by the Resonance Method

P.P. Delsanto, J.D. Alemar, E. Rosario
Puerto Rico Univ., Mayaguez, Puerto Rico
Rept. No. ARO-18757.8-MA-H, 6 pp (Oct 1984), AD-A150 315/0/GAR

KEY WORDS: Sound waves, Wave scattering, Cavities

This investigation of acoustic and ultrasonic scattering examines both direct scattering and much more difficult inverse scattering problems.

85-2121

Prediction of Near Field Intensity Patterns Based on Modal Deformation Patterns

P. Sas, P. Van de Ponseele, R. Snoeys
Catholic Univ. of Leuven, Belgium
Vehicle Noise and Vibration, Instn. Mech. Engr., London Conf. Pub. 1984-5, SAE-MEP 198, pp 189-195, 6 figs, 16 refs

KEY WORDS: Sound waves, Wave radiation, Mathematical models, Finite element technique, Modal analysis

Two computational methods for estimating the sound power radiated by mechanical structures are presented. The reported technique fills in the gap between structural vibrations and radiated sound.

85-2122

Sound Intensity and Its Application in Noise Control

S. Gade
Bruel & Kjaer, Naerum, Denmark
S/V, Sound Vib., 19 (3), pp 14-26 (Mar 1985), 26 figs, 20 refs

KEY WORDS: Acoustic intensity method, Noise reduction

The theoretical concept of sound intensity and its properties are described. Basic applications, such as sound power determination and sound source identification/ranking/mapping, are outlined A review of basic instrumentation systems, calibration procedures, limitations of intensity measurements, and examples of practical applications are included.

85-2123

An Apparatus for Fast Control of Acoustic Properties of Materials

A.M. Bruneau, M. Bruneau, P. Delage
Université du Maine, BP 535, 72017 Le Mans Cedex, France
Appl. Acoust., 18 (4), pp 257-270 (1985), 6 figs, 11 refs

KEY WORDS: Acoustic absorption, Measuring instruments

A method is presented which rapidly estimates the absorption coefficient of materials and the relative quality of different samples of the same material at certain predetermined frequencies. This method makes use of a compact apparatus, containing a sensor, which provides the exciting signal, the acoustic pressure and the acoustic velocity near the material in a cavity, as well as suitable electronic equipment. Experimental results are presented which show that the technique is both reliable and sufficiently accurate.

85-2124

Acoustic Impedance of Small, Circular Orifices in Thin Plates

M.R. Stinson, E.A.G. Shaw
National Res. Council, Ottawa, Ontario K1A 0R6, Canada
J. Acoust. Soc. Amer., 77 (6), pp 2039-2042 (June 1985), 4 figs, 1 table, 17 refs

KEY WORDS: Plates, Holes, Acoustic impedance

Measurements of acoustic impedance have been made on a series of small, circular orifices (0.1 - 0.3 mm radius) in thin plates (0.038 and 0.38 mm thickness). Both real and imaginary components, over the frequency range 0.6-3 kHz, were obtained using an impedance tube technique. The zero frequency limit of resistance was measured with a flow resistance device. Only small amplitude acoustic signals were considered.

SHOCK EXCITATION

85-2125

Local Stability Analysis for a Planar Shock Wave

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NASA Langley Res. Ctr., Hampton, VA
Rept. No. L-15768, NASA-TP-2387, 14 pp (Dec 1984), N85-12864/3/GAR

KEY WORDS: Shock waves, Stability analysis

A procedure to study the local stability of planar shock waves is presented. The procedure is applied to a Ranking-Hugoniot shock in a divergent/convergent nozzle, to an isentropic shock in a divergent/convergent nozzle, and to Rankine-Hugoniot shocks attached to wedges and cones. It is shown that for each case, the equation governing the shock motion is equivalent to the damped harmonic oscillator equation.

85-2126

A High-Angle One-Way Wave Equation for Seismic Wave Propagation Along Rough and Sloping Interfaces

R.R. Greene
Science Applications, Inc., McLean, VA 22102

J. Acoust. Soc. Amer., 77 (6), pp 1991-1998 (June 1985), 1 fig, 2 tables, 13 refs

KEY WORDS: Seismic waves, Wave propagation

A model of acoustic propagation in solid media is derived. It is a one-way wave equation based on a high-order approximation, called a Pade approximation, to the square-root function. The physical properties of the environment are modeled as stratified, thin, homogeneous layers. The model can be applied to obtain an approximate solution in range-dependent environments by allowing the properties of the layers to vary in range. The effects of rough or sloping reflecting interfaces can be approximated using an equivalent reflector, consisting of two thin layers whose properties vary in range.

85-2127

Experimental and Numerical Investigation of a Shock Wave Impingement on a Cylinder

A. Brosh, M.I. Kussoy, C.M Hung
NASA Ames Res. Ctr., Moffett Field, CA

AIAA J., 23 (6), pp 841-846 (June 1985), 9 figs, 17 refs

KEY WORDS: Shock wave-boundary layer interaction

An experimental study and a numerical simulation of the impingement of an oblique shock wave on a cylinder are presented. The investigation was undertaken to attain two goals. The first goal was to experimentally investigate and document the complex three-dimensional shock wave and boundary-layer interaction occurring in practical problems, such as the shock-wave impingement from the Shuttle nose on an external fuel tank, and store interference on a supersonic tactical aircraft. The second goal was to carry out a comparison of experimental measurements and numerical computations of such complex flows.

VIBRATION EXCITATION

85-2128

Parametric Excitation in a Self-Exciting System (4th Report, Region of Subsuperharmonic Resonances of Order 2/3)

S. Yano
Fukui Univ., 3-9-1, Bunkyo, Fukui, Japan

Bull. JSME, 28 (238), pp 671-678 (Apr 1985), 11 figs, 5 refs

KEY WORDS: Superharmonic vibration, Beat phenomena, Parametric excitation

In a self-exciting system with the restoring force expressed as the product of a nonlinear function of deflection and a periodic function of time, it is ascertained that parametric resonances and subharmonic resonances and moreover a subsuperharmonic resonance of order 2/3 occur. An approximate solution of subsuperharmonic resonance of order 2/3 and its stability are determined by a transformation into the rotating coordinates systems and the averaging method. In the neighborhood of the resonance, a vibration with beat character occurs and its amplitudes are approximately determined by obtaining a limit cycle.

85-2129

The Effect of Structural Variations on the Dynamic Behaviour of a System

F. Pinazzi, L. Ricciardiello
CE.TE.NA. - Italian Ship Res. Ctr., Genova, Italy
Computers Struc., 20 (4), pp 659-667 (1985), 11 figs, 7 refs

KEY WORDS: Vibration control, Structural modification techniques

This report analyzes a way of defining the most suitable changes for attenuating structural vibration. The following are studied: the possibility of singling out the most suitable modification area by way of energy considerations; the importance of the modification area, the modifications themselves being equal; and the applicability and validity of the perturbation formulae as a rapid means of forecasting. Two structures are investigated.

85-2130
Short Pipes Climbing Up a Vibrating Vertical Rod
T. Sakai, S. Kiyono
Tohoku Univ., Aza-Aoba, Sendai
Bull. JSME, 28 (238), pp 656-662 (Apr 1985), 9 figs, 2 tables

KEY WORDS: Oscillators, Pipes

An oscillator, a short pipe with a tapered square hole, can, under some conditions, rise along a vertically erected vibrating square rod. Behavior of these oscillators is investigated theoretically and experimentally.

MECHANICAL PROPERTIES

DAMPING

85-2131
Fundamental Investigation on an Oil Damper (4th Report, Simple Harmonic Motions of Its Cylinder and Piston)
T. Asami, H. Sekiguchi
Himeji Inst. of Technology, Himeji, Hyogo, 671-22 Japan
Bull. JSME, 28 (238), pp 663-670 (Apr 1985), 5 figs, 1 table, 4 refs

KEY WORDS: Oil dampers

An investigation into a simple oil damper having an annular clearance between its cylinder and piston as a flow channel of oil is presented. The oil damper is analyzed while the cylinder is vibrating in simple harmonic motion.

85-2132
Random and Impulse Techniques for Measurement of Damping in Composite Materials
S.A. Suarez, R.F. Gibson, L.R. Deobald
Univ. of Idaho, Moscow, ID
Exptl. Tech., 8 (10), pp 19-24 (Oct 1984), 9 figs, 1 table, 9 refs

KEY WORDS: Damping coefficients, Composite materials, Measurement techniques

The increasing use of composite materials in numerous dynamic applications and the lack of valid data on internal damping have motivated the development of accurate and fast damping-measurement techniques that can be easily used, regardless of the ambient environmental conditions. One of the techniques has the potential for making in situ measurements for nondestructive testing. The random and impulse techniques make use of the frequency-domain transfer function of a material specimen under random and impulsive excitation. The results obtained from these techniques are compared with those obtained from a forced sinusoidal-vibration technique which has been used successfully on numerous composite materials.

85-2133
Contribution to the Identification of the Damping Parameters in Linear Continuous Systems
J. Horáček

Inst. of Thermomechanics, Czechoslovak Academy of Sciences, Prague, Czechoslovakia
Strojnícky Časopis, 35 (6), pp 673-684 (1984) 2 figs, 1 table, 8 refs (In Czech)

KEY WORDS: Damping coefficients, Linear systems, Parameter identification technique

A method for the determination of the most appropriate damping model for the vibration of a given continuum system is presented. Three mostly used linear models of damping (viscous damping, Voigt's model and complex modulus) and their all possible linear combinations are considered. The method is based on the linear regression analysis of measured complex eigenvalues in a given frequency range.

85-2134
Fractional Calculus in the Transient Analysis of Viscoelastically Damped Structures
R.L. Bagley, P.J. Torvik
Air Force Inst. of Technology, Wright-Patterson Air Force Base, OH
AIAA J., 23 (6), pp 918-925 (June 1985) 7 figs, 30 refs

KEY WORDS: Damped structures, Viscoelastic properties, Beams, Transient analysis, Finite element technique

Fractional calculus is used to model the viscoelastic behavior of a damping layer in a simply supported beam. The beam is analyzed by using both a continuum formulation and a finite element formulation to predict the transient response to a step loading. The construction of the finite element equations of motion and the resulting nontraditional orthogonality conditions for the damped mode shapes are presented. Also presented are the modified forms of matrix iteration required to calculate eigenvalues and mode shapes for the damped structure.

85-2135
Internal Damping of Short-Fiber Reinforced Polymer Matrix Composites
C.T. Sun, S.K. Chaturvedi, R.F. Gibson
Univ. of Florida, Gainesville, FL
Computers Struc., 20 (1-3), pp 391-400 (1985) 16 figs, 12 refs

KEY WORDS: Composite materials, Internal damping, Optimization, Force balance method, Finite element technique

An analytical study is described to optimize the internal damping of short-fiber polymer matrix composites. Two different analytical methods -- force balance model and finite-element numerical scheme -- are used to obtain numerical results.

85-2136
On the Prediction of Impact Noise, VII: The Structural Damping of Machinery
E.J. Richards, A. Lenzi
Univ. of Southampton, Southampton S09 5NH, UK
J. Sound Vib., 97 (4), pp 549-586 (Dec 22, 1984) 26 figs, 8 tables, 31 refs

KEY WORDS: Machinery noise, Noise prediction, Damping effects

A study aimed at improving damping prediction is described. Based upon an investigation of the values of η_s obtained in industrial machinery structures, as opposed to "thin shell" viscoelastically damped structures, a review is presented of the levels of damping which can be obtained by various standard methods. The effects of bolts and fluid sloshing are included, and specific experiments are described on the effects of adding aggregates in cavities, adding close covers and fitting stick-slip springs on drill rods.

85-2137
Dynamic Analysis and Optimal Design of Mechanical Systems with Constraint Violation Stabilization Method
Chia-Ou Chang
Ph.D. Thesis, Univ. of Iowa, 172 pp (1984) DA8428233

KEY WORDS: Damping coefficients, Optimization

An adaptative mechanism for determining the damping parameters in constraint violation stabilization for dynamic analysis of constrained mechanical systems is developed. Numerical comparison between coordinate partitioning and constraint violation stabilization methods are given for better understanding. The direct differentiation method is used to form the equations of design sensitivity analysis based on constraint violation stabilization method. These sensitivity equations and the equations of motion are integrated simultaneously to obtain the system response as well as the state sensitivity matrices.

85-2138

Single Unit Impact Damper in Free and Forced Vibration

C.N. Bapat, S. Sankar
Concordia Univ., Montreal, Quebec, Canada

J. Sound Vib., 99 (1), pp 85-94 (Mar 8, 1985) 11 figs, 11 refs

KEY WORDS: Impact dampers

The single unit impact damper under free and forced vibrations is studied. The effects of mass ratio, coefficient of restitution, and gap size on the free vibrations are determined by simulating motion on the digital computer.

85-2139

Multiple Rate Shock Isolator Damping Valve

R.M. Foster
Dept. of Air Force, Washington, DC

U.S. Patent Appl. No. 6-651 961/GAR, 21 pp (Sept 19, 1984)

KEY WORDS: Damping coefficients, Valves, Shock isolators

An improved direct acting, hydraulic shock isolator system, including a novel damping valve exhibiting variable damping characteristics depending on degree of valve extension, is described.

FATIGUE

85-2140

Effect of a Very Small Number of Stress Cycles Above Fatigue Limit on Crack Propagation Behavior under Variable Stress Amplitude

A. Fukushima, Y. Kawakami, H. Misawa, S. Kodama
Tokyo Metropolitan Univ., 2-1-1, Fukazawa, Setagaya-ku, Tokyo, 158 Japan

Bull. JSME, 28 (238), pp 578-585 (Apr 1985) 14 figs, 3 tables, 15 refs

KEY WORDS: Fatigue tests, Crack propagation, Steel

Two step two-fold, two step three-fold, and two step multifold program fatigue tests were carried out by rotating bending loading. The material used was a plain carbon steel, JIS S35C, and the specimens were pre-cracked and stress relieved.

85-2141

A Statistical Study on Fatigue Life Distribution Based on the Coalescence of Cracks from Surface Defects

T. Tanaka, T. Sakai, K. Okada
Ritsumeikan Univ., Tohjiin-kita, Kita-ku, Kyoto, Japan

Bull. JSME, 28 (236), pp 209-216 (Feb 1985) 13 figs, 24 refs

KEY WORDS: Fatigue tests, Steel

Rotating bending fatigue tests were carried out on SUS304 stainless steel specimens having three drilled holes with equal distance at the critical section to investigate statistically the propagation behavior of surface cracks and their coalescence leading to a failure of the specimen. Based on the distribution characteristics of crack length at an arbitrary number of cycles, a statistical evaluation was made on the coalescence of cracks as a function of the number of cycles, and the fatigue life distribution was theoretically derived from the above evaluation assuming that the failure occurs immediately after the coalescence of cracks.

85-2142
Dynamic Studies of Running Half-Plane and Cruciform Cracks
L.M. Brock, Y.C. Deng
Univ. of Kentucky, Lexington, KY 40506
Intl. J. Engrg. Sci., 23 (2), pp 163-171 (1985) 3 figs, 16 refs

KEY WORDS: Crack propagation

The dynamic problems of a crack running perpendicularly into a half-plane surface and a cruciform crack running in an unbounded solid under the action of moving point forces are analyzed. The cracks are treated as dislocations distributed w.r.t. speed, so that the problems reduce to singular integral equations with Dirac functions as non-homogeneous terms. Dynamic stress intensity factor and crack opening data are presented.

85-2143
Low Cycle Fatigue Behavior of Aluminum/-Stainless Steel Composites
R.B. Bhagat
Indian Inst. of Technology, Bombay, India
AIAA J., 23 (6), pp 912-917 (June 1985) 5 figs, 5 tables, 36 refs

KEY WORDS: Composite structures, Aluminum, Steel, Fatigue life

Stainless steel wire-reinforced aluminum matrix composites having a wide range of fiber volume fraction (5-56%) were fabricated under optimum conditions of temperature, time, and pressure of hot pressing. These composites were tested in plane bending to complete fracture under cyclic loading at a suitable strain level. The test results were analyzed by computer to obtain a statistically valid mathematical relationship between low cycle fatigue life and fiber volume fraction of the composites.

85-2144
An Improved Procedure for Component Life Estimation with Applications
N.F. Rieger
Stress Technology Inc., Rochester, NY
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 109-121, 14 figs, 8 tables, 10 refs

KEY WORDS: Fatigue life

A general procedure is described for the calculation of fatigue initiation life. The procedure incorporates the effects of steady stresses, dynamic stresses from excitation spectra, and material cyclic properties. The Rainflow cycle counting procedure is used to incorporate complex response waveforms, and the Local Strain approach is used to determine the amount of fatigue damage from each harmonic component.

85-2145
Dynamic Effects on Fracture
J.D. Achenbach
Northwestern Univ., Evanston, IL
Rept. No. AFOSR-TR-85-62, 19 pp (Oct 1983) AD-A150 327/5/GAR

KEY WORDS: Fracture properties, Bibliographies

A summary and a bibliography are presented of the investigations on dynamic effects on fracture in elastic and elastic-plastic materials. Two main areas are investigated: high rate loads on bodies containing cracks, and fast fracture and crack arrest.

WAVE PROPAGATION

85-2146
Radiation from a Point Source and Scattering Theory in a Fluid-Saturated Porous Solid
A.N. Norris
Exxon Res. and Engrg. Co., Annandale, NJ 08801
J. Acoust. Soc. Amer., 77 (6), pp 2012-2023 (June 1985) 1 table, 27 refs

KEY WORDS: Wave propagation, Porous materials, Wave scattering, Biot theory

The time harmonic Green function for a point load in an unbounded fluid-saturated porous solid is derived in the context of Biot's theory. The solution contains the two compressional waves and one transverse wave that are predicted by the theory and have been observed in experiments. The general problem of scattering by an obstacle is considered. Explicit expressions are presented for the scattering amplitudes of the three waves. Simple reciprocity relations between the scattering amplitudes for plane-wave incidence are also given.

85-2147

Non-Linear Propagation Characteristics of Bleustein-Gulyaev Waves

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J. Sound Vib., 96 (4), pp 411-420 (Oct 22, 1984) 7 refs

KEY WORDS: Wave propagation

A pair of semi-linear partial differential equations governing the slow variation in the fundamental and the third harmonic amplitudes of a quasi-monochromatic finite-amplitude Bleustein-Gulyaev (BG) wave on a crystal, belonging to either the 6 mm or the 4mm symmetry class, is derived by using an extension of the method of multiple scales.

EXPERIMENTATION

MEASUREMENT AND ANALYSIS

85-2148

Acoustic Excitation for Modal Response Measurements

B.G. Musson, J.R. Stevens
LTV Aerospace and Defense Co., Dallas, TX

S/V, Sound Vib., 19 (4), pp 24-27 (Apr 1985) 15 figs, 1 table, 1 ref

KEY WORDS: Experimental modal analysis, Plates, Acoustic excitation, Impact hammer tests

Modal test results for a flat-plate specimen with acoustic excitation and mechanical impact excitation are compared with analytical results. The comparison shows that acoustic excitation is a viable alternate to conventional mechanical excitation for modal testing.

85-2149

Use of the Hilbert Transform in Modal Analysis of Linear and Non-Linear Structures

M. Simon, G.R. Tomlinson
Univ. of Manchester, Manchester M13 9PL, UK

J. Sound Vib., 96 (4), pp 421-436 (Oct 22, 1984) 10 figs, 14 refs

KEY WORDS: Modal analysis, Hilbert transforms, Nonlinear systems

An initial study into the application of the Hilbert transform in modal analysis procedures is presented. It is shown that typical structural nonlinearities such as nonlinear damping and stiffness can be detected and identified directly without the need to generate explicit models. The properties of the Hilbert transform are discussed with respect to linear and nonlinear dynamical systems, and a discrete transform, developed from the continuous functions, is derived in the frequency domain and adapted to modal analysis data in the form of mobility transfer functions.

85-2150

A Generalized Multiple-Input, Multiple-Output Modal Parameter Estimation Algorithm

R.R. Craig, Jr., M.A. Blair
Univ. of Texas at Austin, Austin, TX

AIAA J., 23 (6), pp 931-937 (June 1985) 2 figs, 4 tables, 16 refs

KEY WORDS: Experimental modal analysis, Multipoint excitation technique

A new method for experimental determination of the modal parameters of a structure is presented. The method allows for multiple-input forces to be applied simultaneously and for an arbitrary number of acceleration response measurements to be employed. These data are used to form the equations of motion for a damped linear elastic structure. The modal parameters are then obtained through an eigenvalue technique. In conjunction with the development of the equations, an extensive computer simulation study was performed.

85-2151

A New Technique to Measure the Deflection-Time History of a Structure Subjected to High Strain Rates

G.N. Nurick
Univ. of Cape Town, South Africa

Intl. J. Impact Engrg., 3 (1), pp 17-26 (1985) 8 figs, 6 refs

KEY WORDS: Measurement techniques, Dynamic response

Experiments on the dynamic response of structures, particularly beams and plates, subjected to blast and impact loading have been reported by a number of authors. The technique reported in this paper attempts to improve the measurement of the deflection-time history. The method involves the use of light interference and has been used to measure deflections of up to 20 mm.

85-2152

A Stiff and Compact Impact-Force Transducer Based on Strain Measurement

K.G. Sundin, M. Jonsson
Lulea Univ. of Technology, S-951 87 Lulea, Sweden

Exptl. Mech., 25 (1), pp 48-53 (Mar 1985) 7 figs, 1 table, 7 refs

KEY WORDS: Force measurement, Transducers, Strain gages

A stiff and compact transducer for both static and impact compressive forces has been developed. The principle of the transducer is based on measurement of tangential strain around the periphery of an axially loaded short and axisymmetric body. It is shown that for an appropriate choice of transducer geometry the output is nearly insensitive to the distribution of the force over the loaded surface. In an experimental investigation, a prototype of the transducer was subjected to both static and impact loads of different distributions. The results show only a few percent variation in transducer sensitivity for the load distributions used.

85-2153

Probe Waveforms and Deconvolution in the Experimental Determination of Elastic Green's Functions

A.S. Carasso, N.N. Hsu
National Bureau of Standards, Washington, DC 20234

SIAM J. Appl. Math., 45 (3), pp 369-382 (June 1985) 6 figs, 22 refs

KEY WORDS: Impulse response, Time domain method, Green function

A new time domain method for the experimental determination of the impulse response of linear systems is proposed. The technique centers around the use of specifically designed probe waveforms.

85-2154

Effect of an Impulsive Disturbing Load on the Stability of a Statically Loaded Structure

S. Holasut, C. Ruiz
Univ. of Oxford, Oxford OX1 3PJ, UK

Intl. J. Impact Engrg., 3 (1), pp 57-73 (1985) 13 figs, 19 refs

KEY WORDS: Impulse response, Approximation methods

In order to provide some insight into the effect of an impulsive disturbing load on the stability of a structure which is already subjected to major static loads near its critical state, the response of an imperfection sensitive idealized model with one degree of freedom was examined using the analyti-

cal approximation method. Conclusions regarding the response and the stability under the arbitrary form of the impulse are presented.

85-2155
A Review of Holographic Techniques for Structural Analysis
R. Garza, B. Sharp
Newport Corp., Fountain Valley, CA
S/V, Sound Vib., 19 (3), pp 28-30 (Mar 1985) 7 figs, 1 table

KEY WORDS: Holographic techniques, Interferometric techniques

Holographic interferometry techniques are reviewed and applied to structural analysis problems. The procedures benefit finite element modeling, analysis of modal amplitudes, modal analysis of lightweight structures, and modal analysis of complex structures with repeated roots.

DYNAMIC TESTS

85-2156
Behaviour of Fibre-Reinforced Composites under Dynamic Tension
K. Saka, J. Harding
Oxford Univ., UK
Rept. No. AFOSR-TR-85-63, 52 pp (Aug 21, 1984) AD-A150 619/5/GAR

KEY WORDS: Fiber composites, Impact tests, Tensile strength

A small gas gun, capable of accelerating a projectile 1m long by 25.4mm dia. to about 50m/s, and an extended split Hopkinson pressure bar apparatus which have been designed and constructed for the tensile impact testing of fiber-reinforced composite specimens at strain rates of the order of 1000/s are described.

DIAGNOSTICS

85-2157
Rotor Dynamics for Identification of Faults and Balancing of Turbine Generators
J.A. Kubiak, J.E. Aguirre R., S. Marcellin J., A. Rothhirsch L.
Instituto de Investigaciones Eléctricas, Apdo. Postal 475, Cuernavaca, Mor., 62000, Mexico
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 45-50, 4 figs, 2 refs

KEY WORDS: Fault detection, Diagnostic techniques, Turbogenerators, Algorithms, Balancing techniques

In recent work an algorithm of the fault diagnosis for a turbine generator in operation was described. Further development and modification of this algorithm are presented underlining the significance of the rotor dynamic calculation and simulation in the identification of faults. An application of the unbalance response codes for corrective balancing of large turbine generators in the field is also discussed.

85-2158
Antifriction Bearing Pre-Failure Detection Makes Dollars and "Sense"
G.E. Axton
Triad Chemical, Donaldsonville, LA
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 105-113, 6 figs, 9 refs

KEY WORDS: Diagnostic techniques, Rolling contact bearings

Procedures are described for identifying general defects in antifriction bearings from analysis of vibration signals generated by the bearing moving parts. These moving parts are inner and outer raceways, the cage and balls or rollers. Defects on bearing raceways, the cage and rolling ele-

ments, as well as excessive clearance and lack of lubrication, all cause unique vibration signals.

85-2159

Shock Pulses as a Measure of the Lubricant Film Thickness in Rolling Element Bearings

E.O. Schoel
SPM Instrument US Incorporated, Marlborough, CT

Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 121-126, 13 figs, 3 refs

KEY WORDS: Diagnostic techniques, Shock pulse method, Rolling contact bearings, Lubrication

A new practical method is presented for measurement of the lubricant film thickness in the rolling interfaces that carry the load, as well as a more selective means for analyzing bearing damage. This method can be used as a valuable tool for future investigations of lubrication, and is a way to conserve the service life of bearings.

85-2160

How Varying Degrees of Misalignment Affect Rotating Machinery — A Case Study

J.D. Piotrowski
General Electric Co., Evendale, OH

Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 15-22, 25 figs, 1 table

KEY WORDS: Alignment, Rotors, Diagnostic techniques

An alignment study is presented to answer the following questions: How does varying the amount of alignment affect the vibration response of rotating machinery? Does the direction (i.e., relative position of two shafts) affect the vibration response? Can overall vibration levels taken on bearing caps give clues to misalignment conditions both in amount and direction?

85-2161

Expert Systems: The Theory and Applications of an Emerging Technology

P.P. Bonissone
General Electric Co., Schenectady, NY 12345

Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 23-28, 3 figs, 15 refs

KEY WORDS: Diagnostic techniques, Computer-aided techniques

In recent years, expert systems have become the most visible and the fastest growing branch of artificial intelligence. The application of expert system technology to the problem of troubleshooting and the repair of diesel electric locomotives in railroad running repair shops is described.

85-2162

Identification of Misalignment in Turbomachinery

J.A. Kubiak, J. Aguirre R.
Instituto de Investigaciones Electricas, Apdo. Postal 475, 62000 Cuernavaca, Morelos, Mexico

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 23-30, 11 figs, 3 refs

KEY WORDS: Diagnostic techniques, Alignment, Turbomachinery

The types and primary causes of misalignment in turbomachinery, and especially in large turbine-generators are classified and analyzed. Several methods are described for identification of misalignment. The differences between identification of misalignment in turbomachinery of small output and in large turbine-generators are discussed. The vibration patterns of misalignment are determined leading to an identification method which is illustrated with examples.

85-2163

Analysis and Correction of Gearbox Faults

D.B. Szrom

Mechanical Consultants, Inc., Homewood, IL

Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 147-153, 14 figs

KEY WORDS: Diagnostic techniques, Gear boxes, Case histories

Procedures used to identify and correct problems associated with gear reduction units are described. Data acquisition, recording, and analysis as well as solutions to the situations are covered. Review of equipment and techniques required to perform analysis as well as limitations and pitfalls to be avoided are included. Three case histories are shown to illustrate these procedures.

85-2164

Quantitative Acoustic Emission Techniques

C.B. Scruby

UKAEA Atomic Energy Res. Establishment, Harwell, UK

Rept. No. AERE-R-11262, 113 pp (July 1984), N85-16203/0/GAR

KEY WORDS: Diagnostic techniques, Acoustic emission

The potential of acoustic emission as a method for remote detection and location of flaws in a wide range of engineering structures was studied. The basic physical principles underlying the fundamental approach to acoustic emission source characterization are reviewed, and it is shown that it can be used to deduce important and useful information about defect growth. Acoustic emission sources and their radiation of elastic wave energy, and elastic wave propagation are discussed.

85-2165

Subsynchronous Shaft Vibrations on an Industrial Gas Turbine - A Case Study

J.D. McHugh

General Electric Co., Schenectady, NY

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 135-146, 17 figs, 2 refs

KEY WORDS: Diagnostic techniques, Shafts, Subsynchronous vibrations, Case histories

Strong, sub-synchronous vibrations have occurred in a small percentage of a widely-used and highly reliable industrial gas turbine. When these vibrations were first experienced several years ago, a comprehensive test program was initiated to determine the source of these vibrations and what steps could be taken to further reduce their occurrence and severity. The vibrational behavior of these units, the conclusions which were reached from special factory tests and field experience, and the improvements which were made as a result, are described.

85-2166

Case History of a Steam-Turbine Vibration Problem Due to Thermal Effects

N.S. Nathoo, W.G. Gottenberg

Shell Development Co., Houston, TX

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 99-108, 19 figs

KEY WORDS: Diagnostic techniques, Steam turbines, Temperature effects

A theoretical-experimental approach that was used to investigate and rectify abnormal vibration response characteristics of a condensing-extraction type steam turbine is presented. A comprehensive field test program was conducted to determine the probable causes of the high vibrations.

85-2167

A/D - The Key to Automation Diagnostics

L.D. Berry

Orangeburg-Calhoun Technical College, Orangeburg, SC

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 95-97, 2 figs

KEY WORDS: Diagnostic techniques, Digital techniques

The automation of industry poses great challenges to analysts and applications specialists in the area of plant equipment diagnostics. The key to growth in the diagnostics area is the application of digital technology to the various zones of diagnostics. The A/D function, necessary to interface with that of the digital processor, is described.

85-2168

Gear Reducers - Overall Readings are not Enough!

R.W. Jacobs

Monsanto Co., Addyston, OH

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 81-86, 16 figs, 3 refs

KEY WORDS: Monitoring techniques, Gears

A condition monitoring program for gear reducers is described. A case history is presented in which the monitoring program failed to detect a major gear defect. Some strategies for improving the program are discussed.

85-2169

Diagnosing Alternating Current Electric Motor Problems

W.R. Campbell

Arabian American Oil Co., Dhahran, Saudi Arabia

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 65-79, 21 figs, 4 refs

KEY WORDS: Diagnostic techniques, Motors

Whatever the size of electric motor used in today's industry, wear and vibration will eventually be experienced. The problems in diagnosing and taking corrective action are described.

BALANCING

85-2170

Establish Tolerances for Static and Couple Unbalance

R.L. Fox

IRD Mechanalysis, Inc., Houston, TX

Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 1-6, 8 figs, 2 refs

KEY WORDS: Balancing techniques

Five common rotor configurations are examined and, through examples, the resultant forces at the support bearings are illustrated after complying with a typical unbalance tolerance. Conclusions and guidelines are presented to assist in establishing realistic unbalance tolerances, taking into consideration the configuration and dimensions of a rotor.

85-2171

Slow-Speed Balancing of Assembled Rotors to Minimize Rotor Critical Response

R.L. Fox

IRD Mechanalysis, Inc., Houston, TX

Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 11-21, 16 figs, 1 table, 1 ref

KEY WORDS: Balancing techniques, Rotors

Comparative results of applying both simple two-plane and static-couple slow-speed balancing techniques to a super critical rotor subjected to various conditions of unbalance distribution are presented. The effects of various distributions of the static balance correction are also examined.

85-2172
Vibration Analysis and Balancing of a 192 MW Turbine Generator
R.L. Eshleman, D. Jones
Vibration Institute, Clarendon Hills, IL
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 87-94, 14 figs, 6 tables

KEY WORDS: Turbine engines, Balancing techniques

The vibration analysis and balancing of a 192 MW turbine generator which exhibited a thermal bow in the rotor is investigated. The information to perform the diagnosis of the unbalanced and bowed rotor was obtained from test data -- steady state and transient. Balance planes and balance sensitivity were established using a computer model. Using test data and the computer model the excessive vibration of the unit was reduced below its original condition by balancing.

MONITORING

85-2173
Rotating Tool Wear Monitoring Apparatus
K.W. Yee, D.S. Blomquist
Dept. of Commerce, Washington, DC
U.S. Patent No. 4 471 444

KEY WORDS: Monitoring techniques, Machine tools

A system is provided for predicting when the failure of a rotating machine tool or part is imminent or when a tool is worn. The system includes a transducer for producing an output related to the workpiece vibrations caused by the machine tool and an analog comparator which compares this output with a threshold signal related to the normal operation of the tool.

85-2174
A New Method for Rolling Element Bearing Monitoring in the Petrochemical Industry
J.S. Hansen, R.G. Harker
Bently Nevada Corp., Minden, NV
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 139-145, 10 figs, 5 refs

KEY WORDS: Monitoring techniques, Rolling contact bearings, Eddy current probes

A new technique is described which uses eddy current sensors to determine rolling element bearing condition from the direct measurement of outer race deflections. Results are presented from a pump test loop study in which comparisons were made with other monitoring instrumentation commonly used in the petrochemical industry. A summary of findings is provided from an extensive field trial program which spans a broad range of machine configurations, speed, bearing types, and loads.

85-2175
A Review of Rolling Element Bearing Health Monitoring (III) Preliminary Test Results on Current Technologies
P.Y. Kim
National Research Council, Ottawa, Ontario, Canada
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 127-137, 21 figs, 1 table, 14 refs

KEY WORDS: Monitoring techniques, Rolling contact bearings, Railroad cars, Freight cars

After a comprehensive literature review, preliminary tests were carried out on current technologies and instruments available in the market place. Test results are presented in the form of a consumer's report for frontline engineers. These tests focus particularly on the applicability of these technologies to the railroad freight car bearing environment.

85-2176
A Vibration Monitoring Program Using Microcomputers
J.E. Corley
Arabian American Oil Co., Dhahran, Saudia Arabia
Machinery Vibration Monitoring and Analysis Meeting, Proc., June 26-28, 1984, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 61-69, 11 figs, 2 refs

KEY WORDS: Monitoring techniques, Rotating machinery

A system is described for monitoring vibration of rotating equipment on a monthly basis using a microcomputer for maintaining data records. The computer is used for detecting problem equipment with either high vibration levels or statistical deviations from the norm, for producing trend plots and for producing reports to management.

85-2177
The Use of Software for Vibration Monitoring
J.H. Carey
Entek Scientific Corp., Milford, MA
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 129-134, 11 figs, 1 ref

KEY WORDS: Monitoring techniques, Computer programs, Rotating machinery

A software package which can be used to coordinate the data acquisition, organize and manipulate the database and and automate the fault detection role of vibration monitoring is described. It is shown how engineering skills can be used efficiendy to create digitally-stored diagnostic files for specific machines and later utilized for fault diagnostics as part of an expert system.

85-2178
Advanced Predictive Maintenance Programs in the Power Generation Industry
K.R. Piety, E.F. Pardue
Technology for Energy Corp., Knoxville, TN
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 123-128, 2 figs, 3 tables

KEY WORDS: Monitoring techniques, Power plants

Predictive maintenance programs which are on-going at seven utilities are described. All of these programs have adopted the Intelli-Trend predictive maintenance system. A general discussion is provided of the capabilities of this system which offers an IBM-XT computer workstation for data storage and diagnostic analysis coupled with a portable, intelligent data collection instrument.

85-2179
Temporary Sensor Mounting Techniques Available for Large Scale Manual Predictive Maintenance Programs
K.R. Piety, W.M. Bendey, A.C. Collette
Technology for Energy Corp., Knoxville, TN
Machinery Vibration Monitoring and Analysis Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 57-64, 11 figs, 2 tables, 2 refs

KEY WORDS: Monitoring techniques, Mountings

Laboratory tests were conducted to investigate the effects of five different mounting techniques upon measured vibration amplitudes. The performance of a new Quick Connect attachment technique designed for predictive maintenance programs utilizing manual data collection is evaluated.

85-2180
A Survey of Factors Which Affect the Measured Vibration Spectra of Machines
J.B. Catlin
IRD Mechanalysis, Inc.
Machinery Vibration Monitoring and Analysis

Meeting, Proc., May 22-24, 1985, New Orleans, LA, Spons. Vibration Institute, Clarendon Hills, IL, pp 51-56

KEY WORDS: Monitoring techniques, Rotating machinery

One of the primary methods of detecting deterioration in the mechanical condition of a machine is to compare its vibration signatures when it is in good condition (i.e., "baseline" measurements) with those taken at a later date. The variations of the later signatures from the "baseline" are considered a measure of the machine deterioration. Such variations in the signatures, however, can be caused by other factors than machine deterioration, and it is the purpose of this paper to survey the more important of these factors.

ANALYSIS AND DESIGN

ANALYTICAL METHODS

85-2181

Resonance Frequency and Half-Width of Asymmetrical Singlets in High-Q Systems

V. Mohanan

National Physical Lab., New Delhi-110012, India

Appl. Acoust., 18 (3), pp 159-170 (1985) 2 figs, 4 tables, 9 refs

KEY WORDS: Resonant frequency, Curve fitting, Optimization

A simple method, using the optimization curve-fitting technique, is proposed to obtain the resonance frequency and half-width of asymmetrical singlets in high-Q systems in the presence of constant background signals.

85-2182

Substructure Synthesis Methods for Dynamic Analysis of Multi-Body Systems

A.A. Shabana

Univ. of Illinois, Chicago, IL 60680

Computers Struc., 20 (4), pp 737-744 (1985) 10 figs, 10 refs

KEY WORDS: Substructuring methods

Substructure shape functions and shape vectors are used to describe elastic deformation of nonlinear inertia-variant multibody systems. This leads to two different representations of inertia nonlinearities; one is based on a consistent mass formulation, while the other is a lumped mass technique. The multi-body systems considered are collections of interconnected rigid and flexible bodies. Open and closed loop systems are permitted.

85-2183

Computation of the Eigenvalues of a Class of Non-Self-Adjoint Operators

A.M. Lenhoff

Univ. of Delaware, Newark, DE 19716

SIAM J. Appl. Math., 45 (3), pp 360-368 (June 1985) 1 fig, 1 table, 12 refs

KEY WORDS: Eigenvalue problems

A class of linear non-self-adjoint operators is considered which encompasses those arising in certain problems of mathematical physics; e.g., convective heat and mass transfer. These have the property that the non-self-adjoint operator is a weak perturbation of a corresponding self-adjoint operator, with the consequence that, under certain conditions, the solution to an equation involving the non-self-adjoint operator may be found in the form of a biorthogonal expansion in terms of its eigenvalues and eigenvectors. Computational difficulties arise due to the fact that some eigenvalues may be complex; this paper describes an imbedding method which permits reliable location of as many eigenvalues as desired.

85-2184

Parallel Processing for Computational Continuum Dynamics

J.F. McGrath, D.L. Hicks, L.M. Liebrock
KMS Fusion, Inc., Ann Arbor, MI
Rept. No. KMSF-U1539, AFOSR-TR-85-45, 23 pp (Jan 1985) AD-A150 513/0/GAR

KEY WORDS: Numerical methods, Continuum mechanics

The numerical solution of many problems in continuum dynamics is seriously limited by the computation rates attainable on computers with serial architecture. Parallel processing machines can achieve much higher rates. However, applying additional processors to a calculation is only part of the solution. In this report parallel algorithms are developed for explicit and implicit, Lagrangian and Eulerian finite difference schemes for computational continuum dynamics in one spatial dimension.

85-2185
Periodic Solutions of the Parametrically Excited Non-Linear System and the Stability
S. Yano, T. Kotera
Fukui Univ., Fukui, Japan
Strojnícky Časopis, 35 (6), pp 657-672 (1984) 6 figs, 7 refs

KEY WORDS: Parametric excitation, Self-excited vibration

The phenomenon on the interaction between parametric excitation and self-excited vibration is simply described by Van der Pol-Mathieu equation. Periodic solutions in the regions of parametric resonances are approximated by two components for the improvement of accuracy. The stability criterion is explicitly performed by obtaining the regions of instability in Hill's equation in our manner.

85-2186
A Constitutive Operator Splitting Method for Nonlinear Transient Analysis
M.E. Plesha, T. Belytschko
Univ. of Wisconsin, Madison, WI 53706
Computers Struc., 20 (4), pp 767-777 (1985) 5 figs, 3 tables, 15 refs

KEY WORDS: Transient analysis, Constitutive equations

A constitutive operator splitting method for the time integration of the nonlinear dynamic equations of motion which result from the consideration of nonlinear material behavior is studied. In the method, the material constitutive law is split into a constant, history independent relation (implicit portion) and a variable history dependent relation (explicit portion); the resulting constituents are then integrated by implicit and explicit methods, respectively.

85-2187
Period-Doubling Bifurcations and Modulated Motions in Forced Mechanical Systems
S. Tousi, A.K. Bajaj
Purdue Univ., West Lafayette, IN 47907
J. Appl. Mech., Trans. ASME, 52 (2), pp 446-452 (June 1985) 8 figs, 1 table, 23 refs

KEY WORDS: Periodic response, Two degree of freedom systems, Internal resonance, Bifurcation theory

Weakly nonlinear and harmonically forced two-degree-of-freedom mechanical systems with cubic nonlinearities and exhibiting internal resonance are studied for their steady-state solutions. Using the method of averaging, the system is transformed into a four-dimensional autonomous system in amplitude and phase variables. It is shown that for low damping the constant solutions of the averaged equations are unstable over some interval in detuning. The transition in stability is due to the Hopf bifurcation and the averaged system performs limit cycle motions near the critical value of detuning.

85-2188
On the Stability of General Dynamic Systems Using a Liapunov's Direct Method Approach
M. Ahmadian, D.J. Inman
Clemson Univ., Clemson, SC 29631
Computers Struc., 20 (1-3), pp 287-292 (1985) 21 refs

sets of possible damper-spring combinations, given the two masses, which result in the same transient modes of oscillation. Stability regions are developed, and regions of underdamped or overdamped modes are found.

PARAMETER IDENTIFICATION

85-2193
Method of Multiple Scales and Identification of Nonlinear Structural Dynamic Systems
S.V. Hanagud, M. Meyyappa, J.L. Craig
Georgia Inst. of Technology, Atlanta, GA
AIAA J., 23 (5), pp 802-807 (May 1985) 2 figs, 6 tables, 15 refs

KEY WORDS: Parameter identification technique, Nonlinear systems, Single degree of freedom systems

A procedure is developed to identify the parameters of a nonlinear structural dynamic system with a single degree of freedom. A cubic nonlinearity is assumed for purposes of illustration. In comparison to the direct identification procedures, which depend on either the availability of data on all four variables, namely, velocity, acceleration, displacement, and the input of the system, or the formulation of an algorithm that is used to numerically integrate differential equations at each iterative step, the developed procedure requires the data on only one of the field variables and no numerical integration at each step.

OPTIMIZATION TECHNIQUES

85-2194
Transient Response Optimization of Vibrating Structures by Liapunov's Second Method
B.P. Wang, L. Kitis, W.D. Pilkey
Univ. of Texas at Arlington, Arlington, TX 76019
J. Sound Vib., 96 (4), pp 505-512 (Oct 22, 1984) 5 figs, 2 tables, 8 refs

KEY WORDS: Optimization, Transient response, Lyapunov's method, Vibration absorption (equipment)

Liapunov's second method is applied to minimize an integrated square performance measure for damped vibrating structures subjected to initial excitation. The method reduces the calculation of the performance measure and its derivatives with respect to design parameters to the solution of a set of linear algebraic equations. The computational effectiveness of the method is illustrated by applying it to the classical vibration absorber and to a cantilever beam carrying an absorber at its midpoint.

DESIGN TECHNIQUES

85-2195
Optimum Design and Automated Dynamic Analysis of Flexible Mechanisms
I.G. Tadjbakhsh
Rensselaer Polytechnic Inst., Troy, NY
Rept. No. ARO-17575.6-EG, 4 pp (Dec 10, 1984), AD-A150 152/7/GAR

KEY WORDS: Slider crank mechanisms, Four bar mechanisms, Dynamic stability, Optimum design

Flexible mechanisms such as slider crank and four-bar mechanisms are modeled and their dynamic instability and optimum design analyzed. The primary aim of the project was a thorough understanding and analysi of conditions of dynamic instability in fl ible components of mechanisms and rob

COMPUTER PROGRAMS

85-2196
Structural Analysis of Cable-Reinforced Inflatables
O.G. Vinogradov
Univ. of Calgary, Calgary, Alberta, Canada T2N 1N4
Computers Struc., 20 (4), pp 759-766 (1985), 10 figs, 11 refs

J.F. McGrath, D.L. Hicks, L.M. Liebrock
KMS Fusion, Inc., Ann Arbor, MI
Rept. No. KMSF-U1539, AFOSR-TR-85-45, 23 pp (Jan 1985) AD-A150 513/0/GAR

KEY WORDS: Numerical methods, Continuum mechanics

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KEY WORDS: Periodic response, Two degree of freedom systems, Internal resonance, Bifurcation theory

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On the Stability of General Dynamic Systems Using a Liapunov's Direct Method Approach
M. Ahmadian, D.J. Inman
Clemson Univ., Clemson, SC 29631
Computers Struc., 20 (1-3), pp 287-292 (1985) 21 refs

KEY WORDS: Lumped parameter method, Lyapunov method

A technique is presented for studying the stability of equilibrium of linear lumped-parameter systems involving general types of forces such as dissipative, non-conservative, gyroscopic, and circulatory. A modified approach to solving the Liapunov equation is used to provide a function V which is exploited to present different stability criteria for the equilibrium of such systems.

85-2189

Linear Dynamic Poroelasticity with Microstructure for Partially Saturated Porous Solids

J.G. Berryman, L. Thigpen

Lawrence Livermore National Lab., Livermore, CA

J. Appl. Mech., Trans. ASME, 52 (2), pp 345-350 (June 1985) 18 refs

KEY WORDS: Porous materials, Fluid-filled media, Equations of motion, Linear theories

Linear equations of motion are derived to describe the behavior of small disturbances in a porous solid containing both liquid and gas. Appropriate boundary conditions are derived to guarantee the uniqueness of the solutions of these equations.

85-2190

A Load-Dependent Basis for Reduced Nonlinear Structural Dynamics

S.R. Idelsohn, A. Cardona

INTEC, Santa Fe, Argentina

Computers Struc., 20 (1-3), pp 203-210 (1985) 8 figs, 9 refs

KEY WORDS: Reduction methods, Nonlinear structures, Finite element technique, Rayleigh-Ritz technique, Wilson method

A computational algorithm for predicting the dynamical response of a nonlinear structure by means of a reduction scheme is described. In it, the nonlinear system of ordinary differential equations obtained from the finite element discretization is reduced, by employing a Rayleigh-Ritz technique. A new criterion for the computation of the basis vectors is proposed.

85-2191

Dynamic Response of Mechanical Systems by a Weak Hamiltonian Formulation

M. Borri, G.L. Ghiringhelli, M. Lanz, P. Mantegazza

Politecnico di Milano, Milan, Italy

Computers Struc., 20 (1-3), pp 495-508 (1985) 7 figs, 3 tables, 22 refs

KEY WORDS: Hamiltonian Principle, Approximation methods

The paper explains the appropriate use of Hamilton's Weak Principle (HWP) in the development of consistent and efficient approximations for the determination of the response of mechanical systems. It is shown how the HWP can be used to provide explicit and implicit integration formulae and to study the response and stability of nonlinear periodic systems.

85-2192

Some New Algebraic Results for the Synthesis and Analysis of Transients of a Two-Degree-of-Freedom Linear Dynamic System

F. Sticher

N.S.W. Inst. of Technology, Sydney, Australia

Mech. Mach. Theory, 20 (1), pp 59-69 (1985) 5 figs

KEY WORDS: Two degree of freedom systems, Transient response

It is shown that a simple approach to the transients of a two-degree-of-freedom system, using complex number notation, yields some elegant results after suitable algebraic manipulation. The typical two-mass, two-spring and two-damper system is studied since the equations of motion are similar to any physical linear two-degree-of-freedom system one may devise. In particular, it is shown that there are up to six different

sets of possible damper-spring combinations, given the two masses, which result in the same transient modes of oscillation. Stability regions are developed, and regions of underdamped or overdamped modes are found.

PARAMETER IDENTIFICATION

85-2193
Method of Multiple Scales and Identification of Nonlinear Structural Dynamic Systems
S.V. Hanagud, M. Meyyappa, J.I. Craig
Georgia Inst. of Technology, Atlanta, GA
AIAA J., 23 (5), pp 802-807 (May 1985) 2 figs, 6 tables, 15 refs

KEY WORDS: Parameter identification technique, Nonlinear systems, Single degree of freedom systems

A procedure is developed to identify the parameters of a nonlinear structural dynamic system with a single degree of freedom. A cubic nonlinearity is assumed for purposes of illustration. In comparison to the direct identification procedures, which depend on either the availability of data on all four variables, namely, velocity, acceleration, displacement, and the input of the system, or the formulation of an algorithm that is used to numerically integrate differential equations at each iterative step, the developed procedure requires the data on only one of the field variables and no numerical integration at each step.

OPTIMIZATION TECHNIQUES

85-2194
Transient Response Optimization of Vibrating Structures by Liapunov's Second Method
B.P. Wang, L. Kitis, W.D. Pilkey
Univ. of Texas at Arlington, Arlington, TX 76019
J. Sound Vib., 96 (4), pp 505-512 (Oct 22, 1984) 5 figs, 2 tables, 8 refs

KEY WORDS: Optimization, Transient response, Lyapunov's method, Vibration absorption (equipment)

Liapunov's second method is applied to minimize an integrated square performance measure for damped vibrating structures subjected to initial excitation. The method reduces the calculation of the performance measure and its derivatives with respect to design parameters to the solution of a set of linear algebraic equations. The computational effectiveness of the method is illustrated by applying it to the classical vibration absorber and to a cantilever beam carrying an absorber at its midpoint.

DESIGN TECHNIQUES

85-2195
Optimum Design and Automated Dynamic Analysis of Flexible Mechanisms
I.G. Tadjbakhsh
Rensselaer Polytechnic Inst., Troy, NY
Rept. No. ARO-17575.6-EG, 4 pp (Dec 10, 1984), AD-A150 152/7/GAR

KEY WORDS: Slider crank mechanisms, Four bar mechanisms, Dynamic stability, Optimum design

Flexible mechanisms such as slider crank and four-bar mechanisms are modeled and their dynamic instability and optimum design analyzed. The primary aim of the project was a thorough understanding and analysis of conditions of dynamic instability in flexible components of mechanisms and robots.

COMPUTER PROGRAMS

85-2196
Structural Analysis of Cable-Reinforced Inflatables
O.G. Vinogradov
Univ. of Calgary, Calgary, Alberta, Canada T2N 1N4
Computers Struc., 20 (4), pp 759-766 (1985), 10 figs, 11 refs

KEY WORDS: Inflatable structures, Cable stiffened structures, Wind-induced excitation, Computer programs

A computer simulation of behavior of cable-reinforced inflatable structures subjected to internal pressure, wind pressure, static concentrated and harmonic oscillating loads, and interacting with surrounding air is outlined. The simulation is based on a structure discretization approach with a cable under the constant pressure being used as a finite element. A numerical example given shows that the wind pressure and attached mass and damping significantly affect the dynamic response of the structure.

GENERAL TOPICS

CONFERENCE PROCEEDINGS

85-2197

NOISE-CON 85. Computers for Noise Control

Proc. 1985 Natl. Conf. on Noise Control Engrg., Ohio State Univ., Columbus, OH, June 3-5, 1985. Spons. Ohio State Univ. and INCE, R. Singh, ed. Avail: Noise Control Foundation, P.O. Box 3469, Arlington Branch, Poughkeepsie, NY 12603, $48.00

KEY WORDS: Computer aided techniques, Noise reduction, Proceedings

The conference and this volume emphasize the use of computers and advanced techniques for analysis, design, measurement, control and diagnostics in acoustics and noise control engineering. The papers included here deal with all types of computers, including personal computers (PC's) and dedicated laboratory processors such as FFT analyzers. Virtually all the topics of current interest are addressed.

TUTORIALS AND REVIEWS

85-2198

New Directions for Mechanism Kinematics and Dynamics

A.G. Erdman, D.R. Riley

Univ. of Minnesota, Minneapolis, MN

Computers Mech. Engrg., 3 (6), pp 10-20 (May 1985), 15 figs, 2 tables, 10 refs

KEY WORDS: Computer-aided techniques

Computers can free students to explore open-ended design projects, provided that basic concepts in mechanical engineering are understood. Synthesis and analysis software and instructional programs with dynamic blackboards which provide new approaches to teaching are examined.

85-2199

Audiovisual Materials and Microcomputer Software for Teaching Vibration and Sound

F.B. Stumpf

Ohio Univ., Athens, OH 45701-2979

J. Acoust. Soc. Amer., 77 (6), pp 1989-1990 (June 1985), 4 refs

KEY WORDS: Computer programs

Currently available films, filmloops, slides, overhead transparencies, and microcomputer software are listed for those who teach courses involving vibration and sound. The topics covered and addresses of the suppliers are given.

AUTHOR INDEX

CALENDAR

1985

NOVEMBER

4-8 Acoustical Society of America, Fall Meeting [ASA] Nashville, TN (ASA)

11-14 Truck and Bus Meeting and Exposition [SAE] South Bend, IN (SAE)

17-22 American Society of Mechanical Engineers, Winter Annual Meeting [ASME] Miami Beach, FL (ASME)

24-26 Australian Acoustical Society Annual Conference, Leura, Australia (A. Lawrence, Graduate School, University of N.S.W., Box 1, Kensington, N.S.W. 2033, Australia)

DECEMBER

11-13 Western Design Engineering Show [ASME] Anaheim, CA (ASME)

1986

JANUARY

28-30 Reliability and Maintainability Symposium [ASME] Las Vegas, NV (ASME)

FEBRUARY

3-6 4th International Modal Analysis Conference [Union College] Los Angeles, CA (Ms. Rae D'Amelio, Union College, Wells House, Schenectady, NY 12308 - (518) 370-6288)

MARCH

5-7 Vibration Damping Workshop II [Flight Dynamics Laboratory of the Air Force Wright Aeronautical Labs.] Las Vegas, NV (Mrs. Melissa Arrajj, Administrative Chairman, Martin Marietta Denver Aerospace, P.O. Box 179, Mail Stop M0486, Denver, CO 80201 - (303) 977-8721)

24-27 Design Engineering Conference and Show [ASME] Chicago, IL (ASME)

APRIL

8-11 International Conference on Acoustics, Speech, and Signal Processing [Acoustical Society of Japan, IEEE ASSP Society, and Institute of Electronics and Communication Engineers of Japan] Tokyo, Japan (Hiroya Fujisaki, EE Department, Faculty of Engineering, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan)

13-16 American Power Conference [ASME] Chicago, IL (ASME)

29-1 9th International Symposium on Ballistics [Royal Armament Research and Development Establishment] RMCS, Shrivenham, Wiltshire, UK (Mr. N. Griffiths, OBE, Head/XT Group, RARDE, Fort Halstead, Sevenoaks, Kent TN14 7BP, England)

MAY

12-16 Acoustical Society of America, Spring Meeting [ASA] Cleveland, OH (ASA Hqs.)

JUNE

3-6 Symposium and Exhibit on Noise Control [Hungarian Optical, Acoustical, and Cinematographic Society; National Environmental Protection Authority of Hungary] Szeged, Hungary (Mrs. Ildiko Baba, OPAKFI, Anker koz 1, 1061 Budapest, Hungary)

4-6 Machinery Vibration Monitoring and Analysis Meeting [Vibration Institute] Las Vegas, NV (Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 W. 55th St., Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254)

8-12 Symposium on Dynamic Behavior of Composite Materials, Components and Structures [Society for Experimental Mechanics] New Orleans, LA (R.F. Gibson, Mech. Engrg. Dept., University of Idaho, Moscow, ID 83843 - (208) 885-7432)

JULY

20-24 International Computers in Engineering Conference and Exhibition [ASME] Chicago, IL (ASME)

21-23 INTER-NOISE 86 [Institute of Noise Control Engineering] Cambridge, MA (Professor Richard H. Lyon, Chairman, INTER-NOISE 86, INTER-NOISE 86 Secretariat, MIT Special Events Office, Room 7-111, Cambridge, MA 02139)

24-31 12th International Congress on Acoustics, Toronto, Canada (12th ICA Secretariat, P.O. Box 123, Station Q, Toronto, Ontario, Canada M4T 2L7)

SEPTEMBER

14-17 International Conference on Rotordynamics [IFToMM and Japan Society of Mechanical Engineers] Tokyo, Japan (Japan Society of Mechanical Engineers, Sanshin Hokusei Bldg., 4-9, Yoyogi 2-chome, Shibuyak-ku, Tokyo, Japan)

22-25 World Congress on Computational Mechanics [International Association of Computational Mechanics] Austin, Texas (WCCM/TICOM, The University of Texas at Austin, Austin, TX 78712)

OCTOBER

5-8 Design Automation Conference [ASME] Columbus, OH (ASME)

5-8 Mechanisms Conference [ASME] Columbus, OH (ASME)

19-23 Power Generation Conference [ASME] Portland, OR (ASME)

20-22 Lubrication Conference [ASME] Pittsburgh, PA (ASME)

NOVEMBER

30-5 American Society of Mechanical Engineers, Winter Annual Meeting [ASME] San Francisco, CA (ASME)

CALENDAR ACRONYM DEFINITIONS AND ADDRESSES OF SOCIETY HEADQUARTERS

AHS	American Helicopter Society 1325 18 St. N.W. Washington, D.C. 20036
AIAA	American Institute of Aeronautics and Astronautics 1633 Broadway New York, NY 10019
ASA	Acoustical Society of America 335 E. 45th St. New York, NY 10017
ASCE	American Society of Civil Engineers United Engineering Center 345 E. 47th St. New York, NY 10017
ASLE	American Society of Lubrication Engineers 838 Busse Highway Park Ridge, IL 60068
ASME	American Society of Mechanical Engineers United Engineering Center 345 E. 47th St. New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103
ICF	International Congress on Fracture Tohoku University Sendai, Japan
IEEE	Institute of Electrical and Electronics Engineers United Engineering Center 345 E. 47th St. New York, NY 10017
IES	Institute of Environmental Sciences 940 E. Northwest Highway Mt. Prospect, IL 60056
IMechE	Institution of Mechanical Engineers 1 Birdcage Walk, Westminster London SW1, UK
IFToMM	International Federation for Theory of Machines and Mechanisms U.S. Council for TMM c/o Univ. Mass., Dept. ME Amherst, MA 01002
INCE	Institute of Noise Control Engineering P.O. Box 3206, Arlington Branch Poughkeepsie, NY 12603
ISA	Instrument Society of America 67 Alexander Dr. Research Triangle Pk., NC 27709
SAE	Society of Automotive Engineers 400 Commonwealth Dr. Warrendale, PA 15096
SEE	Society of Environmental Engineers Owles Hall, Buntingford, Hertz. SG9 9PL, England
SESA	Society for Experimental Mechanics (formerly Society for Experimental Stress Analysis) 14 Fairfield Dr. Brookfield Center, CT 06805
SNAME	Society of Naval Architects and Marine Engineers 74 Trinity Pl. New York, NY 10006
SPE	Society of Petroleum Engineers 6200 N. Central Expressway Dallas, TX 75206
SVIC	Shock and Vibration Information Center Naval Research Laboratory Code 5804 Washington, D.C. 20375-5000

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PUBLICATION POLICY

Unsolicited articles are accepted for publication in the **Shock and Vibration Digest.** Feature articles should be tutorials and/or reviews of areas of interest to shock and vibration engineers. Literature review articles should provide a subjective critique/summary of papers, patents, proceedings, and reports of a pertinent topic in the shock and vibration field. A literature review should stress <u>important</u> recent technology. Only pertinent literature should be cited. Illustrations are encouraged. Detailed mathematical derivations are discouraged; rather, simple formulas representing results should be used. When complex formulas cannot be avoided, a functional form should be used so that readers will understand the interaction between parameters and variables.

Manuscripts must be typed (double-spaced) and figures attached. It is strongly recommended that line figures be rendered in ink or heavy pencil and neatly labeled. Photographs must be unscreened glossy black and white prints. The format for references shown in **Digest** articles is to be followed.

Manuscripts must begin with a brief abstract, or summary. Only material referred to in the text should be included in the list of References at the end of the article. References should be cited in text by consecutive numbers in brackets, as in the following example:

> Unfortunately, such information is often unreliable, particularly statistical data pertinent to a reliability assessment, as has been previously noted [1].
>
> Critical and certain related excitations were first applied to the problem of assessing system reliability almost a decade ago [2]. Since then, the variations that have been developed and practical applications that have been explored [3-7] indicate . . .

The format and style for the list of References at the end of the article are as follows:

-- each citation number as it appears in text (not in alphabetical order)
-- last name of author/editor followed by initials or first name
-- titles of articles within quotations, titles of books underlined
-- abbreviated title of journal in which article was published (see Periodicals Scanned list in January, June, and December issues)
-- volume, issue number, and pages for journals; publisher for books
-- year of publication in parentheses

A sample reference list is given below.

1. Platzer, M.F., "Transonic Blade Flutter -- A Survey," Shock Vib. Dig., <u>7</u> (7), pp 97-106 (July 1975).

2. Bisplinghoff, R.L., Ashley, H., and Halfman, R.L., <u>Aeroelasticity</u>, Addison-Wesley (1955).

3. Jones, W.P., (Ed.), "Manual on Aeroelasticity," Part II, Aerodynamic Aspects, Advisory Group Aeronaut. Res. Dev. (1962).

Articles for the **Digest** will be reviewed for technical content and edited for style and format. Before an article is submitted, the topic area should be cleared with the editors of the **Digest**. Literature review topics are assigned on a first come basis. Topics should be narrow and well-defined. Articles should be 3000 to 4000 words in length. For additional information on topics and editorial policies, please contact:

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